DISASTER MITIGATION IN INDONESIA

FOR ITW ONLY

Dr. Iwan G. Tejakusuma

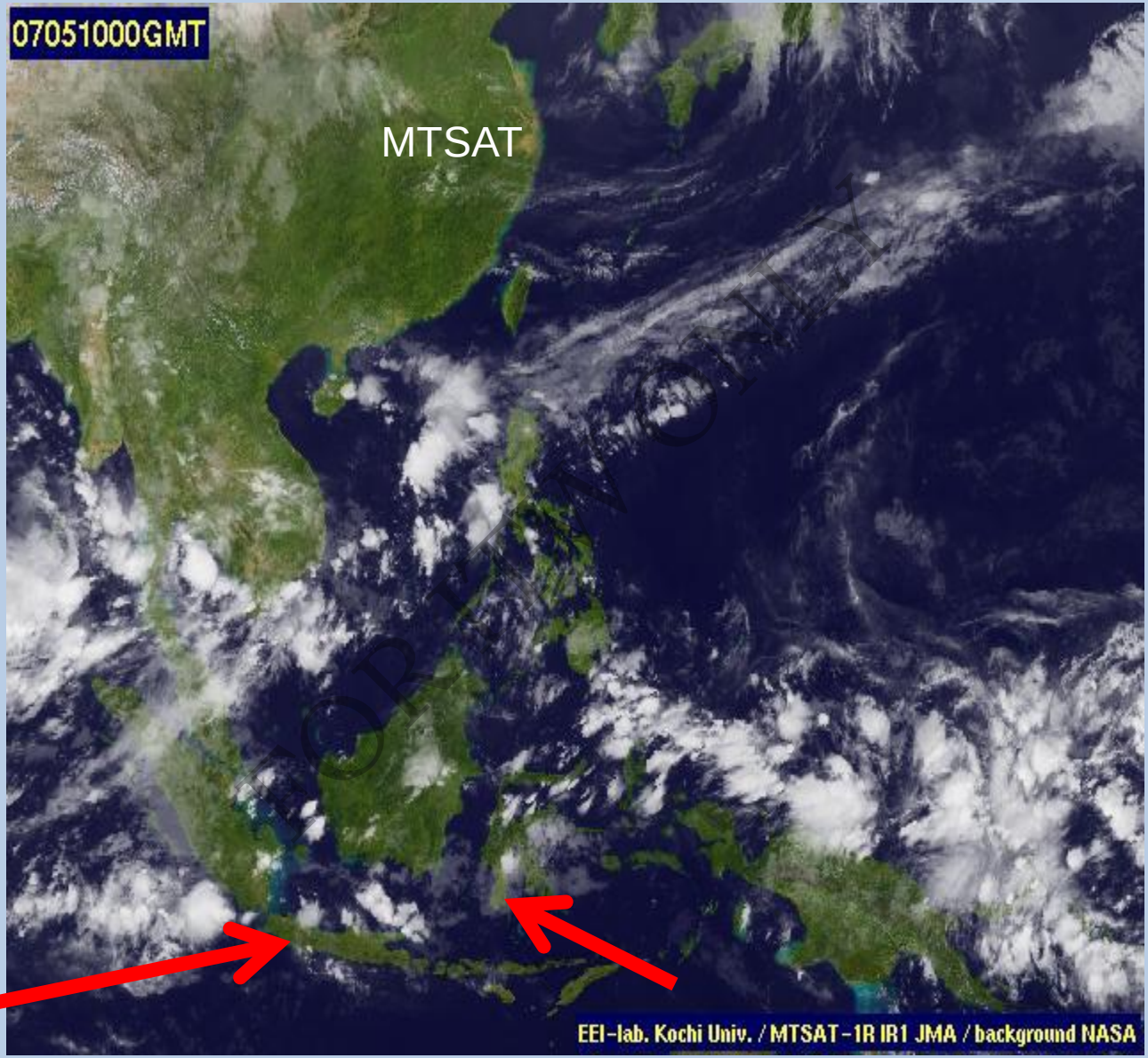
Agency for the Assessment and Application of Technology

BPPT – Jakarta INDONESIA

International Training Workshop

On Natural Disaster Reduction

2010 Taiwan


07051000GMT
MTSAT
EEI-lab. Kochi Univ. / MTSAT-1R IR1 JMA / background NASA

- High rainfall rate and slope instability has resulted in many landslide disasters in Indonesia that causing loss of human life and economic losses.

- Landslide disaster becoming more frequent in accordance with increases of human activities, land degradation and changes in rainfall pattern.

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Landslide and Flash Flood in Trenggalek – East Java

20 April 2006
12 District
11 people killed

Collapsed road

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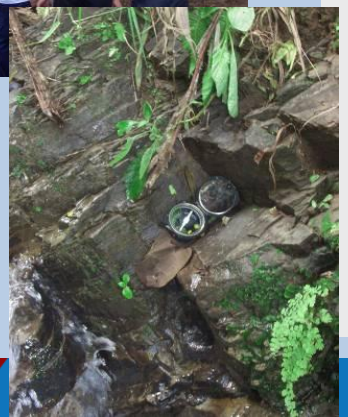
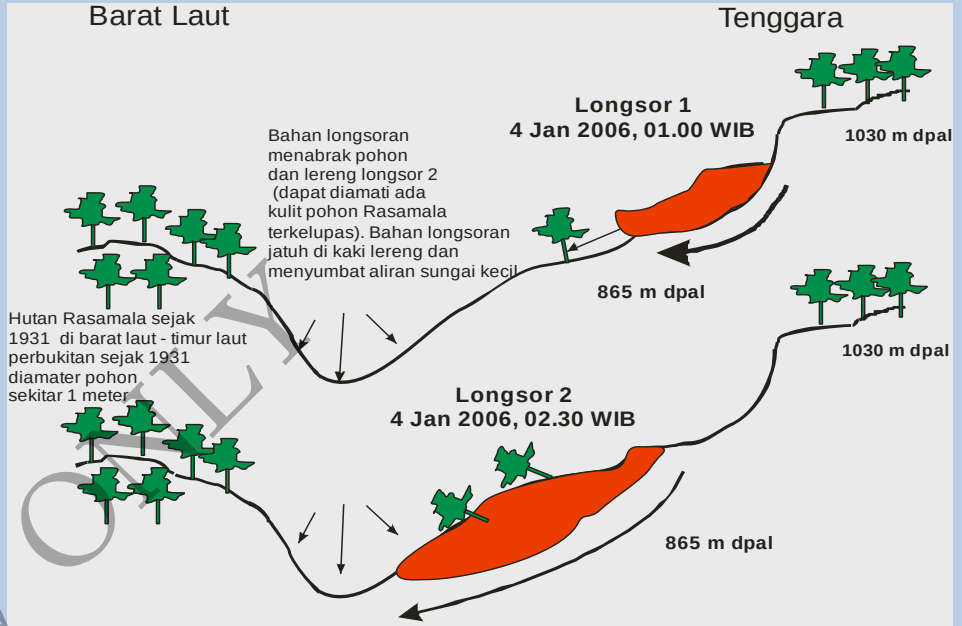
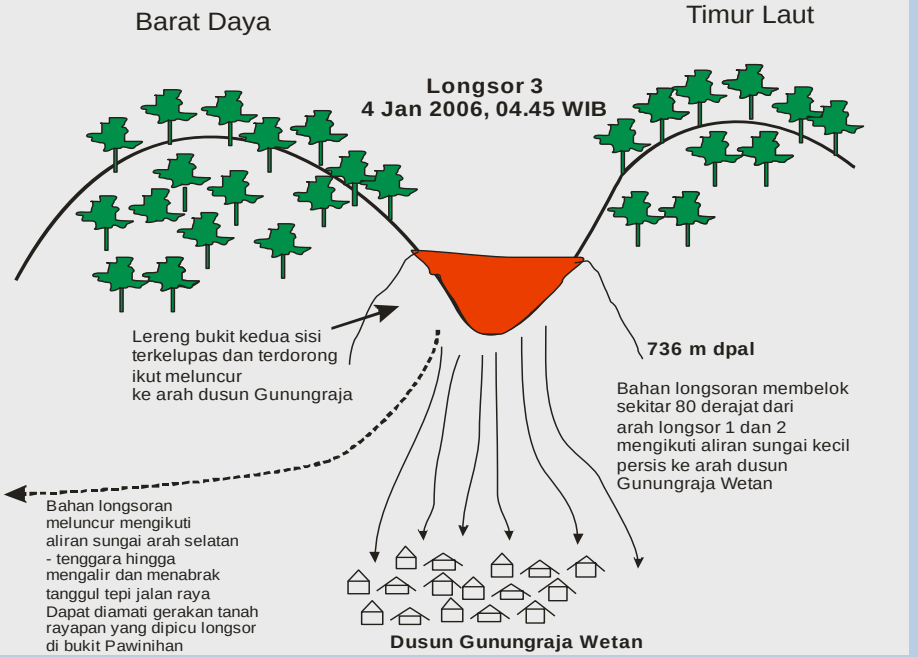
Landslide in Sijeruk Village - Banjarnegara – Central Java Province

- 4 Januari 2006 early morning.
- 34 people died, 19 houses damage



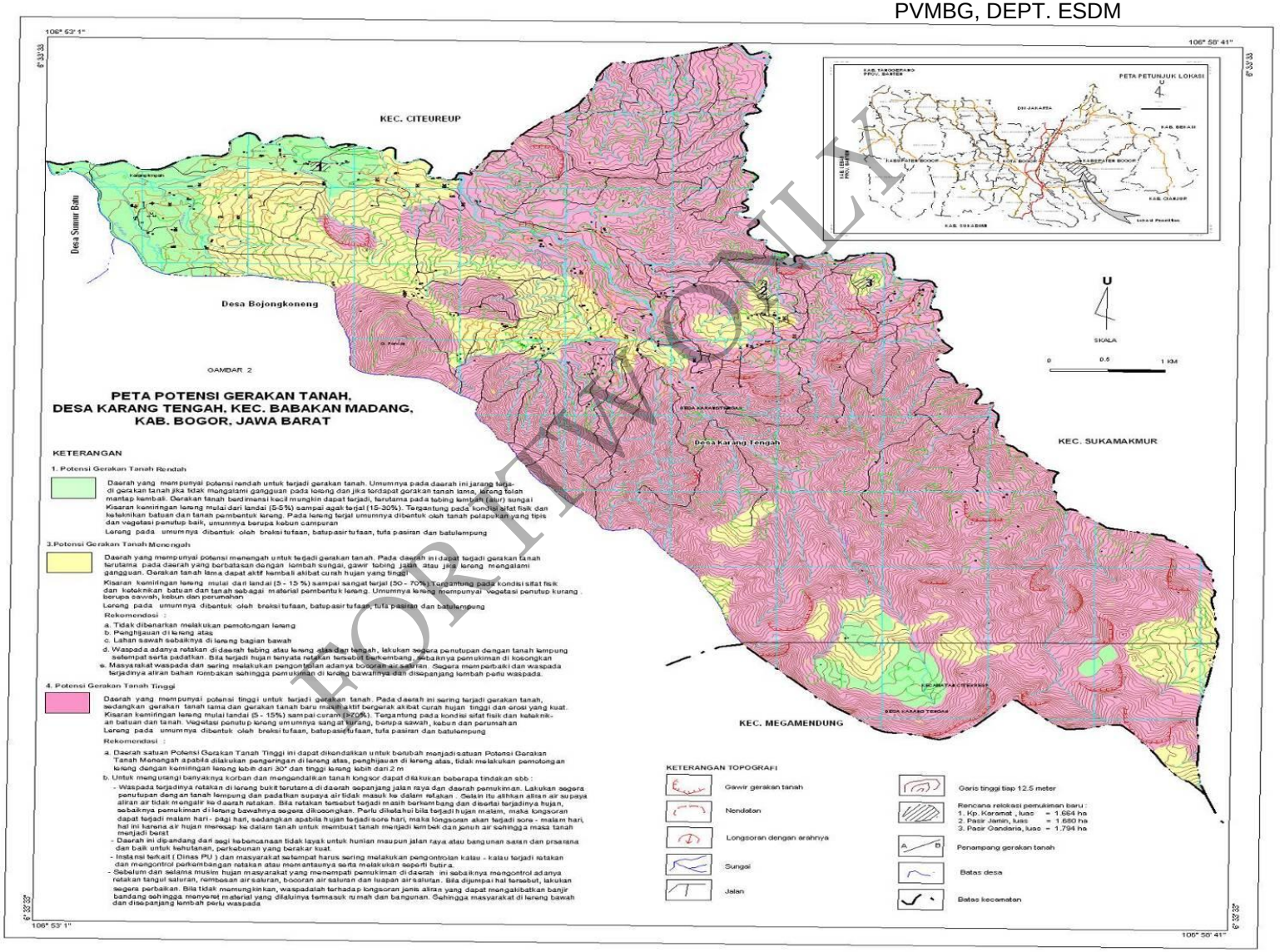




REVIEW ONLY

Landslide Susceptibility Map

PVMBG, DEPT. ESDM



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Bencana Longsor Dusun Ngledoksari Kecamatan Tawangmangu Kabupaten Karanganyar - Propinsi Jawa Tengah

- Terjadi pada **25 Desember 2007** dini hari sekitar jam 12 tengah malam dan jam 4 pagi.
- Jumlah korban **34** orang meninggal, **19** rumah rusak / hancur.

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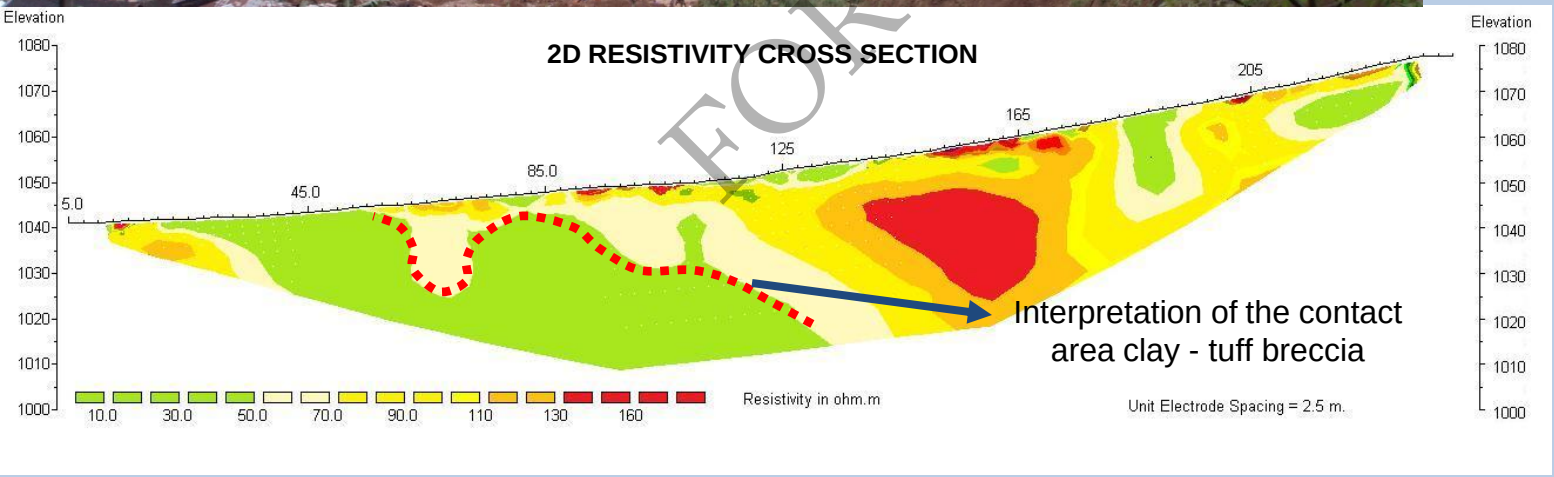
SLOPE STABILITY INTERPRETATION BASED ON 2D RESISTIVITY SURVEY RESULTS

Resistvity (Ohmm)	Lithology Interpretation
0 – 50	Clay – silty Tuff
50 – 70	Silty tuff – Sandy tuff
70 – 100	Sand
100 - 130	Gravely Sand
> 130	Volcanic Breccia



FOR REVIEW ONLY

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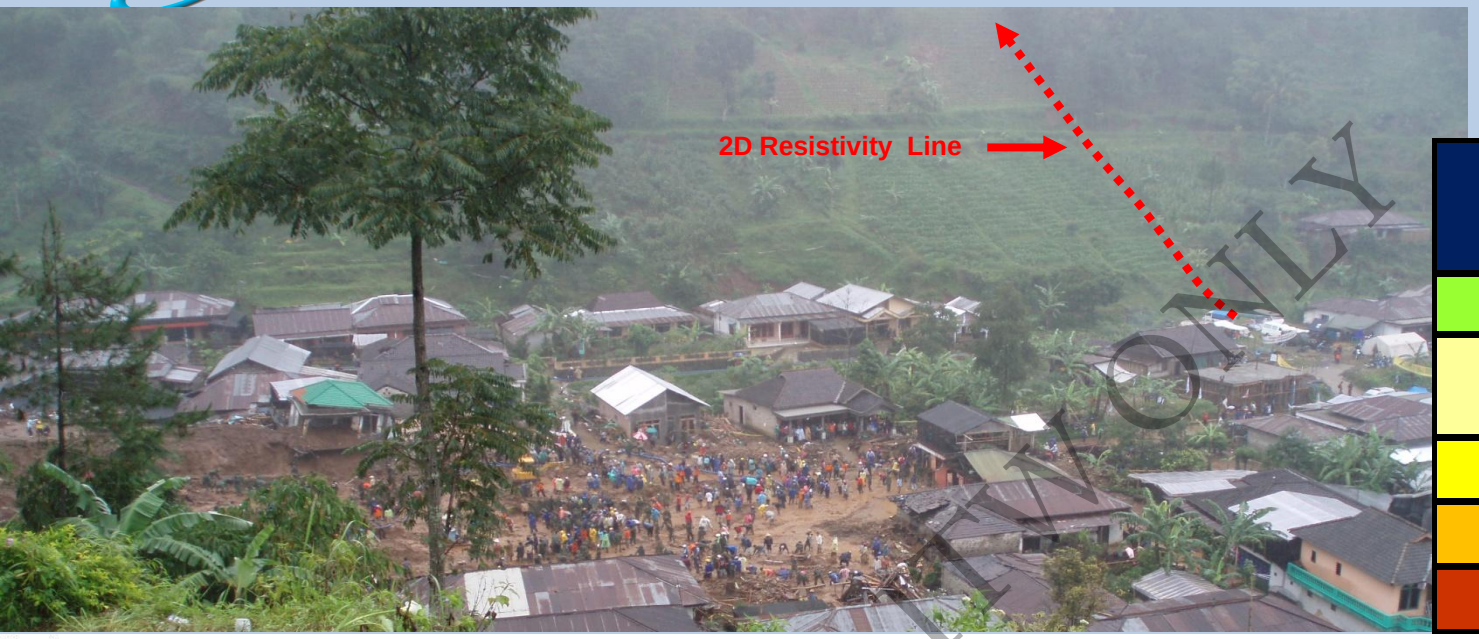

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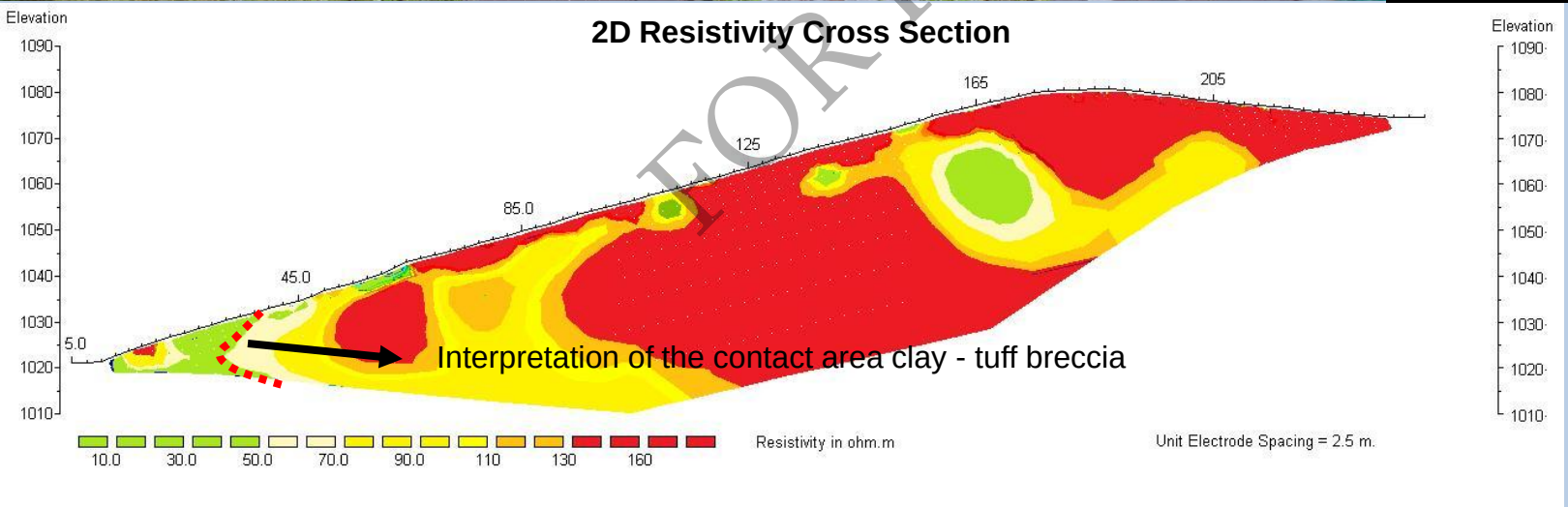
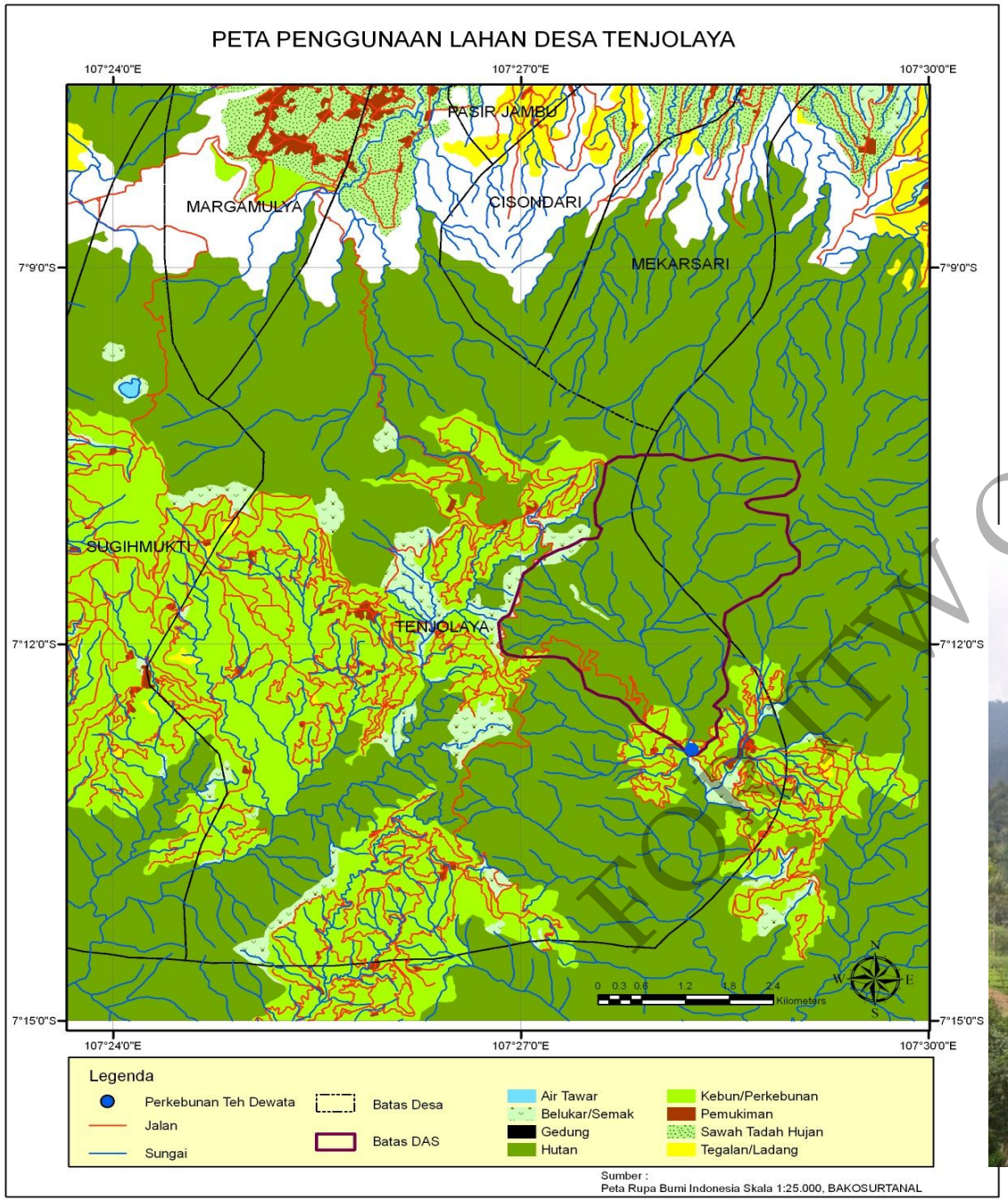


FOR TW ONLY



- Hutan di bagian hulu dan DAS Tenjolaya masih sangat baik.
- Cagar Alam Gunung Tilu di bawah tanggung jawab Balai Konservasi Sumberdaya Alam (BKSDA).
- Dari luas DAS Tenjolaya (1041,92 ha):
  - Hutan = 95,47%
  - Perkebunan = 2,80%
  - Semak belukar = 1,72%

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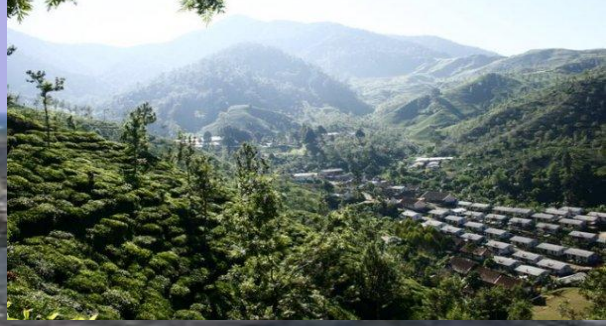
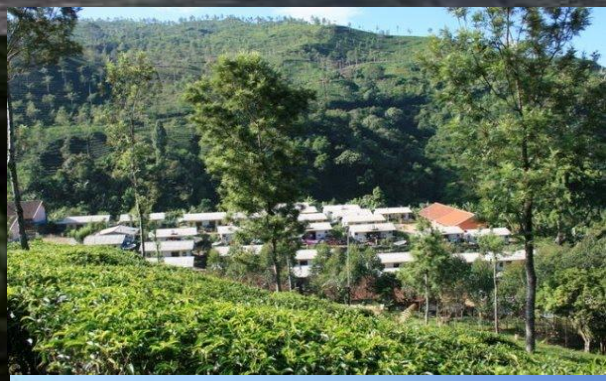
BEFORE LANDSLIDE





http://putihtih.blogspot.com/2010/02/foto-perkebunan-teh-dewata-ciwidey.html

Land Cover in Landslide Crown Area

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Landslide Reconstruction

Landslide Disaster in CIWIDEY

23 Februari 2010 at about 08:00

ANALISIS - SINTESIS

- Potensi longsor susulan cukup besar.
- Adanya mataair yang mempercepat proses kejenuhan dan menurunkan kestabilan tanah
- Mahkota longsor berasal dari lereng bukit dengan kemiringan curam. Kelerengan dititik longsor (70% hingga >100%)
- Material longsoran berupa bahan rombakan di tebing mengalir melalui celah bukit, berbelok ke arah permukiman penduduk.
- Tutupan lahan di daerah mahkota longsor merupakan hutan alam primer-hutan alam sekunder, dengan funsi lahan sebagai bagian dari Cagar Alam Gunung Tilu di bawah tanggung jawab Balai Konservasi Sumberdaya Alam (BKSDA).
- Tidak ada jaminan bahwa hutan yang baik aman terhadap longsor secara mutlak.
- Longsor dipicu oleh hujan, kondisi batuan setempat dan kemiringan lereng yang curam.
- Jenis longsoran : debris flow
- Permukiman dibangun pada daerah lembah yang memiliki risiko terkena longsor.

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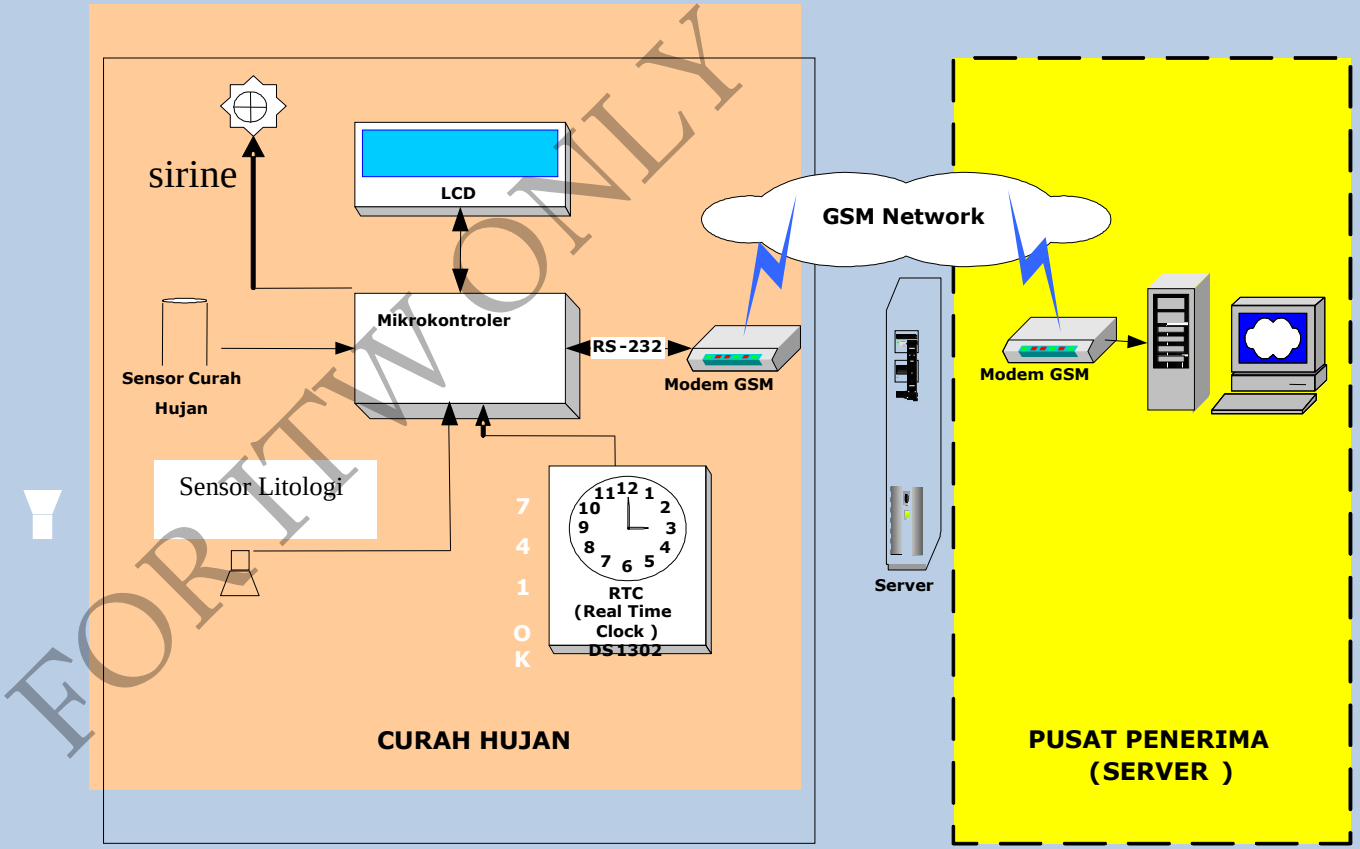
(Landslide Early Warning System)

Data-data klimatologi dan litologi diambil secara langsung ke *Weather Envoy* dengan menggunakan kabel, kemudian data tersebut dikirim dengan menggunakan gelombang mikro (telemetri) menggunakan jaringan selular (GSM). Sistem ini dapat bekerja secara *stand alone* maupun dapat bekerja secara terintegrasi.



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Konsep dasar jaringan pengiriman data curah hujan dan soil moisture (LEWS) untuk memantau longsor melalui saluran GSM.

LEWS *(Landslide Early Warning System)*

NOT FOR SALE

eather odification,
in order to itigate, eather and limate isaster in ndonesia

The Agency for the Assessment and Application of Technology (Badan Pengkajian dan Penerapan Teknologi - BPPT) has been doing cloud seeding project since 1979. The Weather Modification Unit is a unit under BPPT, which has capability to perform the cloud seeding all over Indonesia.

Cloud seeding is a technology by which inefficient clouds are made more efficient by the introduction of aerosols (seeding agents) of types lacking in nature.

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Facilities and Instrumentation

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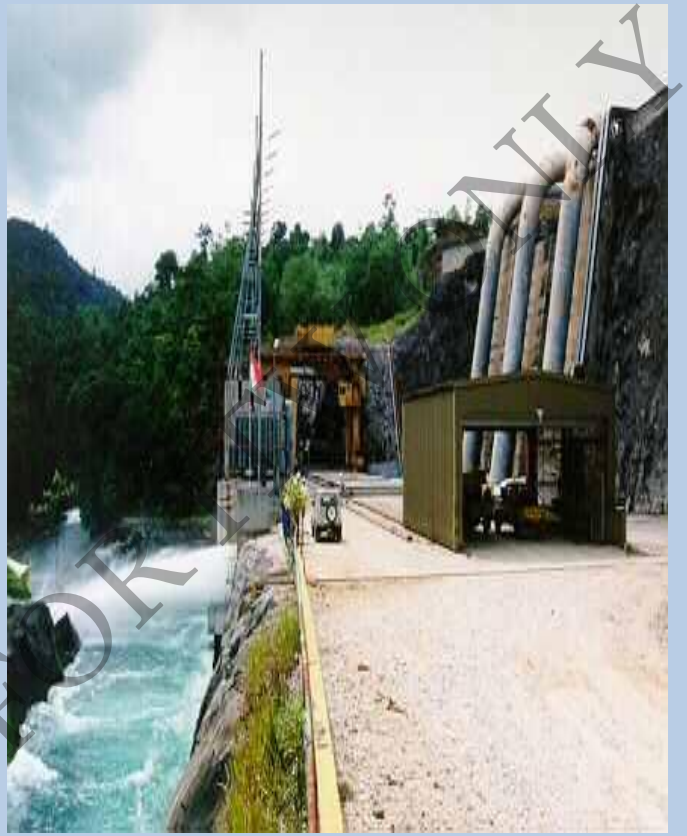
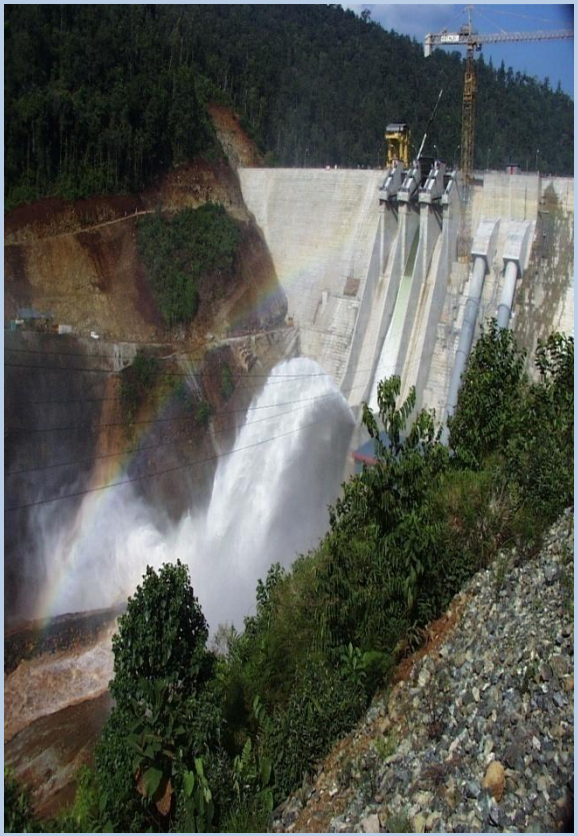
Flares Type

Powder Type

FOR ITWON

Cloud Seeding for Rain Enhancement





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Flood Prevention in Jakarta

FOR TEST ONLY

Heavy Flood in Jakarta 1990-2006
(Kompas 3 Feb 2007)

23 Jan 1990
21 Dec 1991
24 Jan 1992
28 Feb 1992
16 Mar 1992
23 April 1992
3 Dec 1992
10 Jan 1993
8 Jan 1994
25-26 Mar 1995
12-14 Oct 1995
15 Nov 1995
9-14 Jan 1996
2 Apr 1996
15 Oct 1996
13-14 Jan 1997
12 May 1998
26-28 Jan 1999
6 Feb 2001
14-15 Jan 2002
23 Jan 2002
28 Jan 2002
29 Jan 2002
30 Jan 2002
1-2 Feb 2002
12 Jan 2004
17 Feb 2004
21 Apr 2004
28 May 2004
12 Jul 2004
29 Nov 2004
12 Dec 2004
21 Jan 2005
23 Jan 2005
6 Mar 2005
16 Jun 2005
15 Jul 2005
17 Jan 2006
20 Apr 2006
31 Jan 2007
1-5 Feb 2007
1-2 Nov 2007
1 Feb 2008

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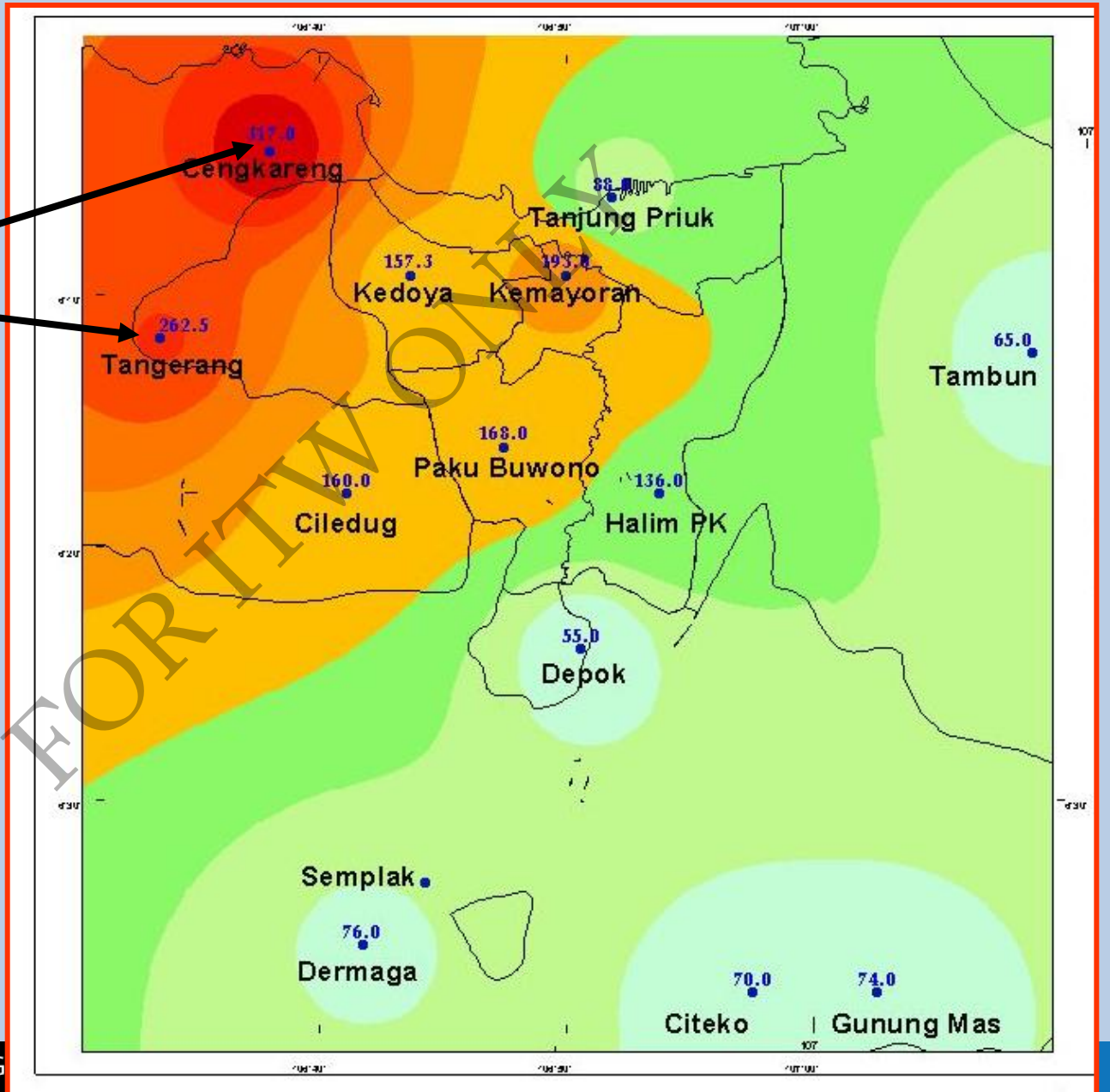
Daily Rainfall
Jakarta area, 01 February 2008

Rainfall

- Tj. Priuk : 88 mm
- BMG (kmy) : 193 mm
- Cengkareng: 317 mm
- Tangerang : 262.5 mm
- Paku Buono: 168 mm
- Halim Pk : 136 mm
- Ps Minggu : - mm
- Cileduk :160 mm
- Kedoya :157.3 mm
- Depok : 55 mm

11. Tambun : 65 mm

12. Citeko : 70 mm
13. Gunung mas: 74 mm
14. Dermaga : 76 mm



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Source: BMKG, Indonesia

Weather Modification Technology for Flood Prevention:

Clouds which developed over Java Sea (North of Jakarta) should be seeded to prevent those clouds become heavy rain over Jakarta area.

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SEA LEVEL RISE

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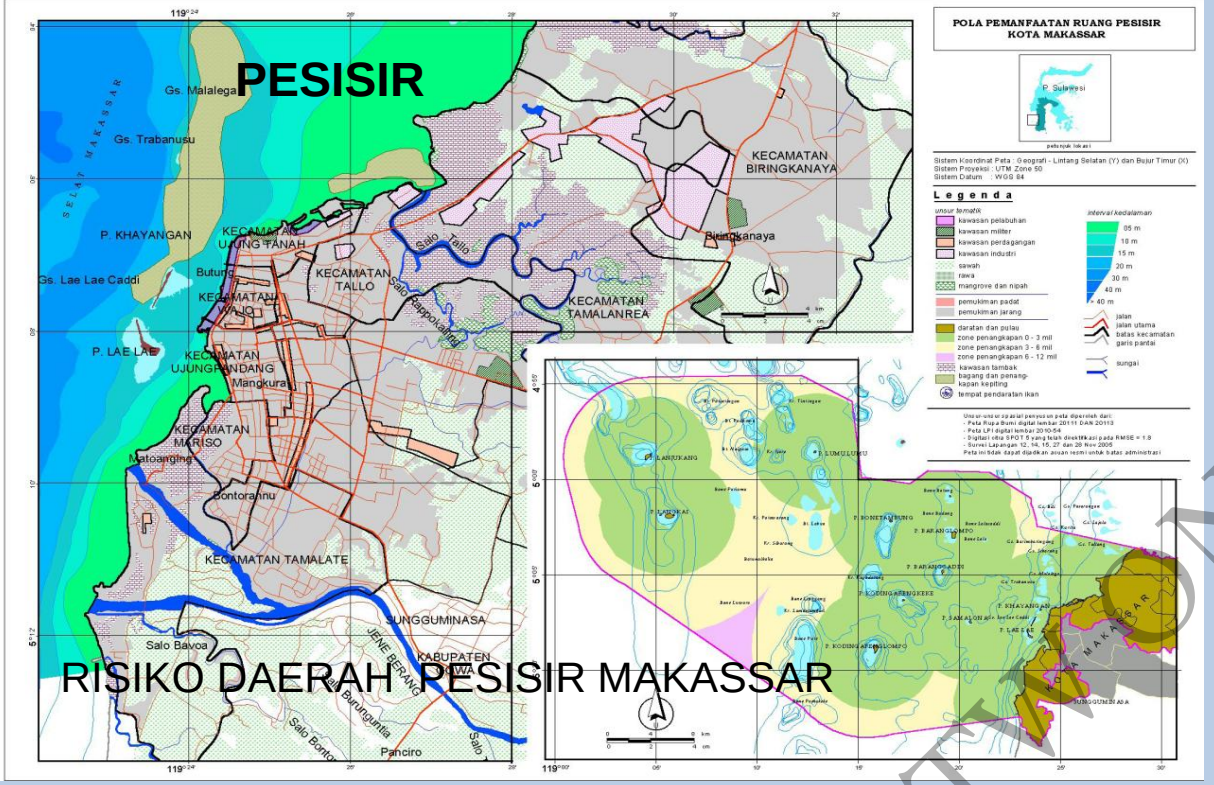
PESISIR



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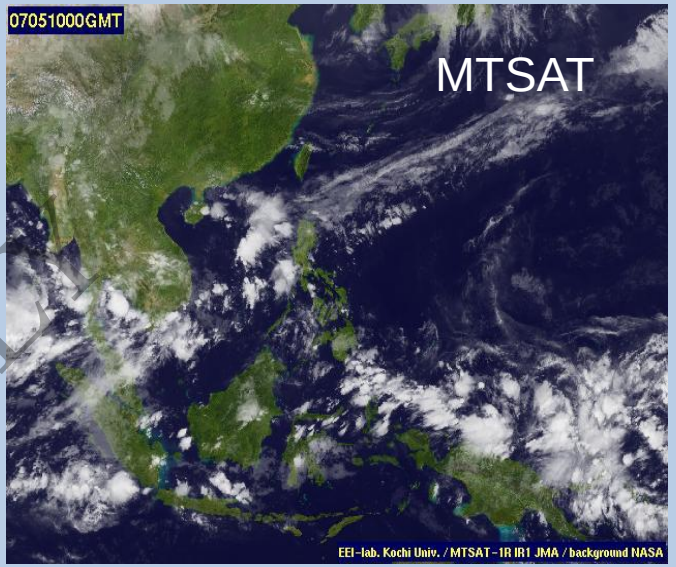
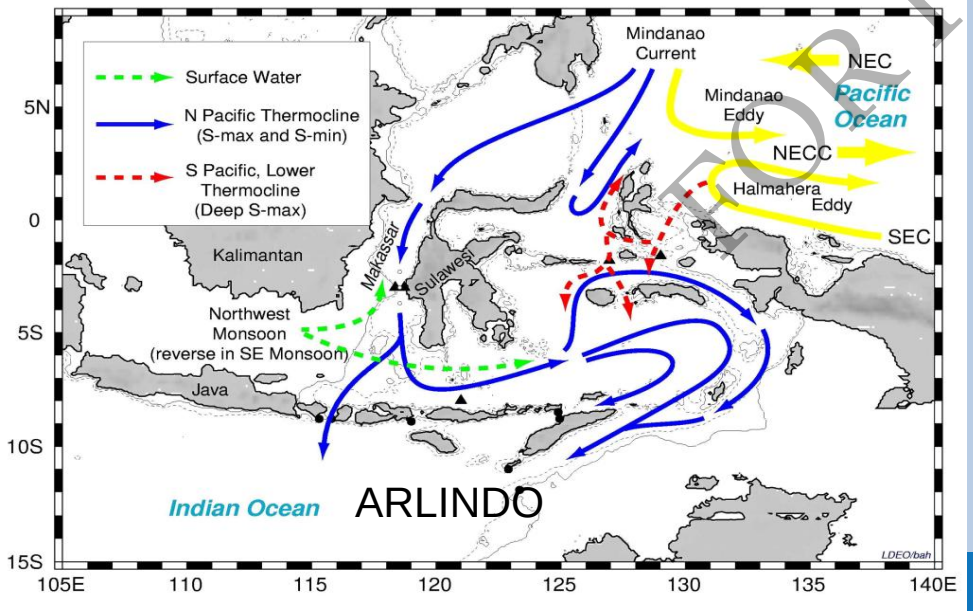
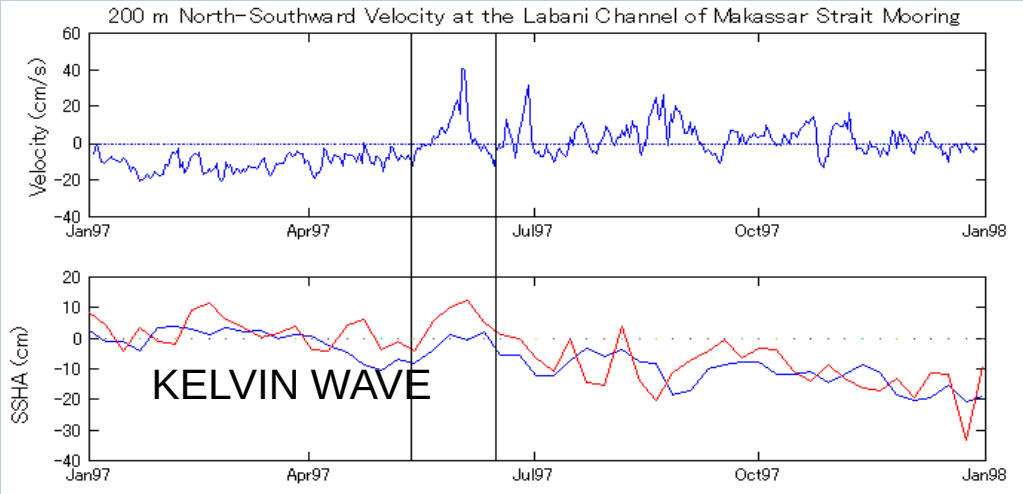


PEMANASAN GLOBAL



LAUT



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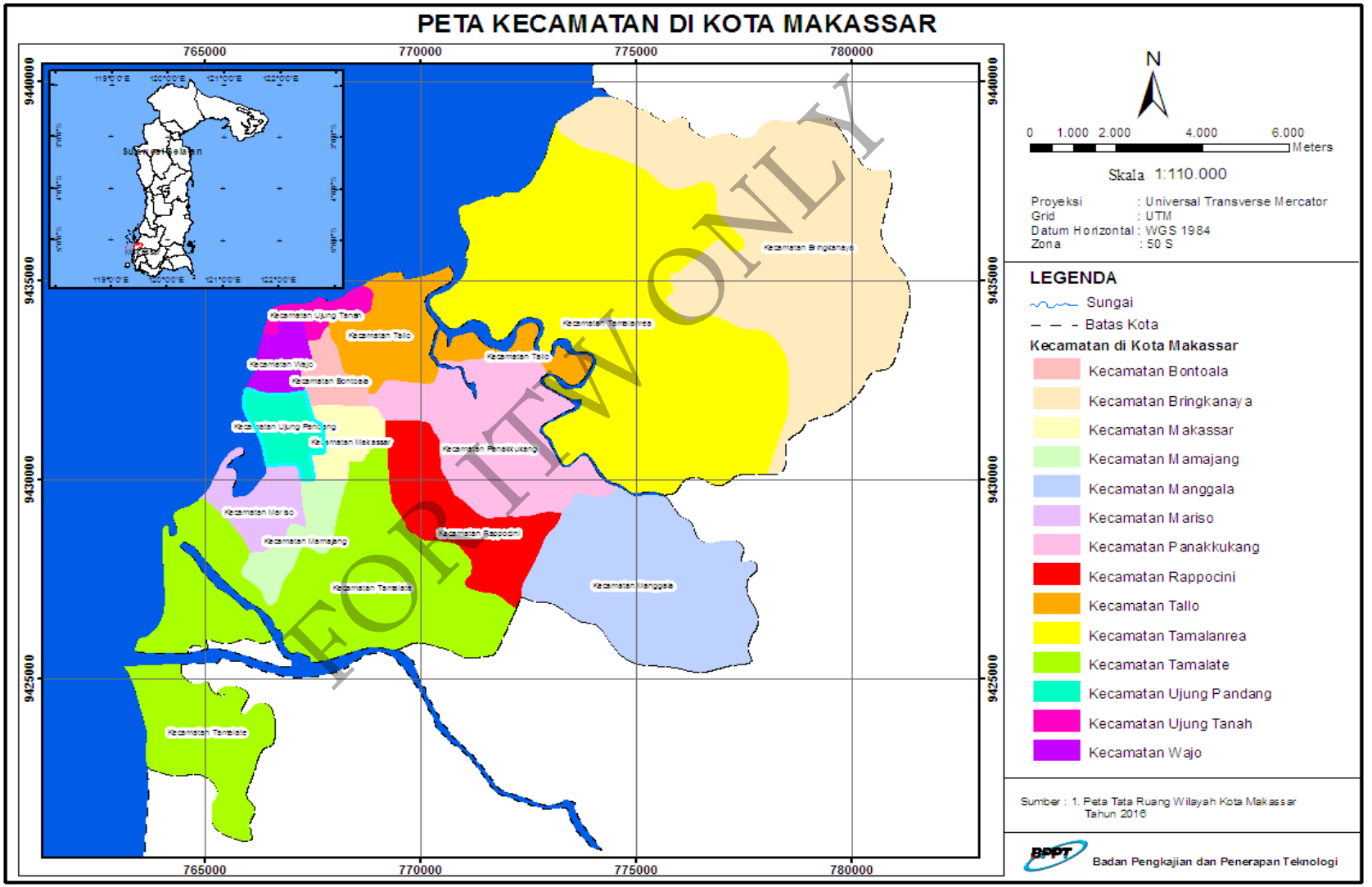
PETA KECAMATAN DI KOTA MAKASSAR
765000
770000
775000
780000
9440000
9435000
9430000
9425000
N
0 1.000 2.000 4.000 6.000
Meters
Skala 1:110.000
Proyeksi : Universal Transverse Mercator
Grid : UTM
Datum Horizontal : WGS 1984
Zona : 50 S
LEGENDA
Sungai
Batas Kota
Kecamatan di Kota Makassar
Kecamatan Bontoala
Kecamatan Bringkanaya
Kecamatan Makassar
Kecamatan Mamajang
Kecamatan Manggala
Kecamatan Mariso
Kecamatan Panakkukang
Kecamatan Rappocini
Kecamatan Tallo
Kecamatan Tamalanrea
Kecamatan Tamalate
Kecamatan Ujung Pandang
Kecamatan Ujung Tanah
Kecamatan Wajo
Sumber : 1. Peta Tata Ruang Wilayah Kota Makassar Tahun 2016
Badan Pengkajian dan Penerapan Teknologi
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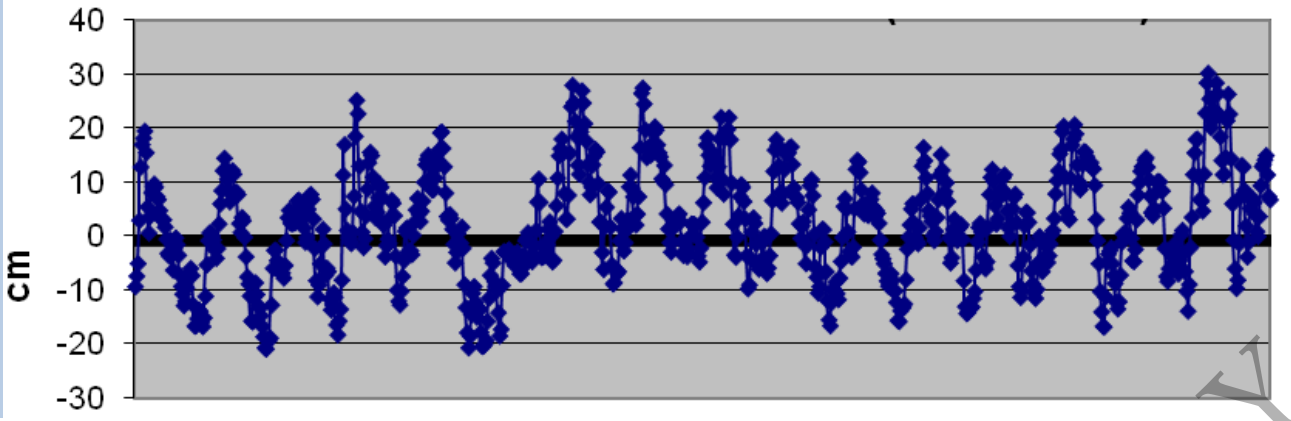
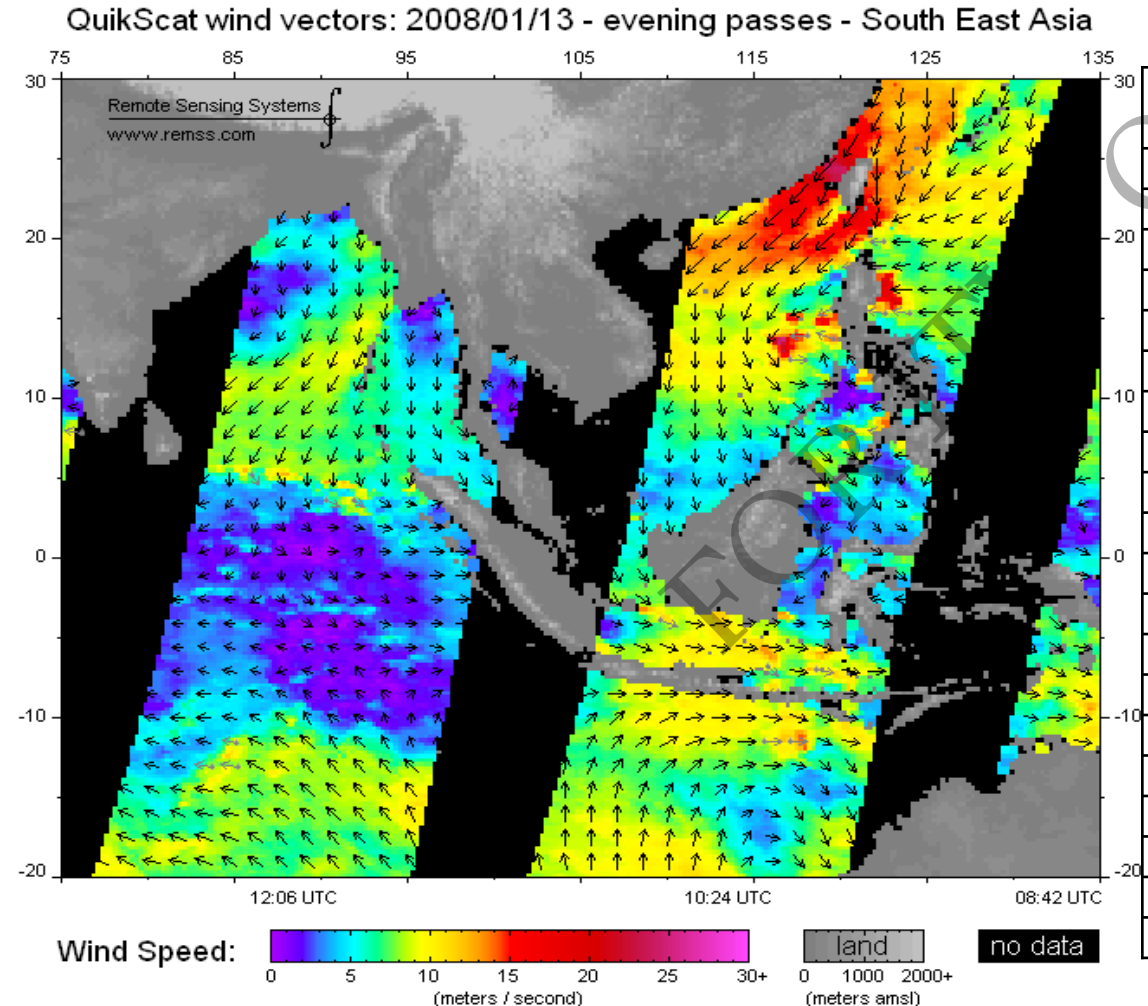


Analisis Faktor Laut dan Atmosfer



Tahun/bulan /hari	Angin	
	Kecepatan (m/s)	Arah
19990801	7.2	arah barat laut-utara
20000107	5.2	arah timur-tenggara
20001022	3.6	arah timur- utara
20010211	7.6	arah tenggara-selatan
20010701	6	arah barat laut-utara
20011125	3	arah timur- utara
20020901	7.8	arah barat laut-utara
20030119	6.2	arah selatan
20030824	6.8	arah barat laut-utara
20031228	8	arah barat daya - selatan
20040808	8.2	arah utara
20041219	3.8	arah utara-timur
20050731	7	arah barat laut – timur laut
20060219	5.2	arah barat daya - tenggara
20060723	7.2	arah barat laut - utara
20070225	5	arah timur
20070930	7.8	arah barat laut -utara
20080113	4.4	arah barat daya - timur
20080608	6.8	arah selatan - barat
20081109	4.4	arah timur - tenggara

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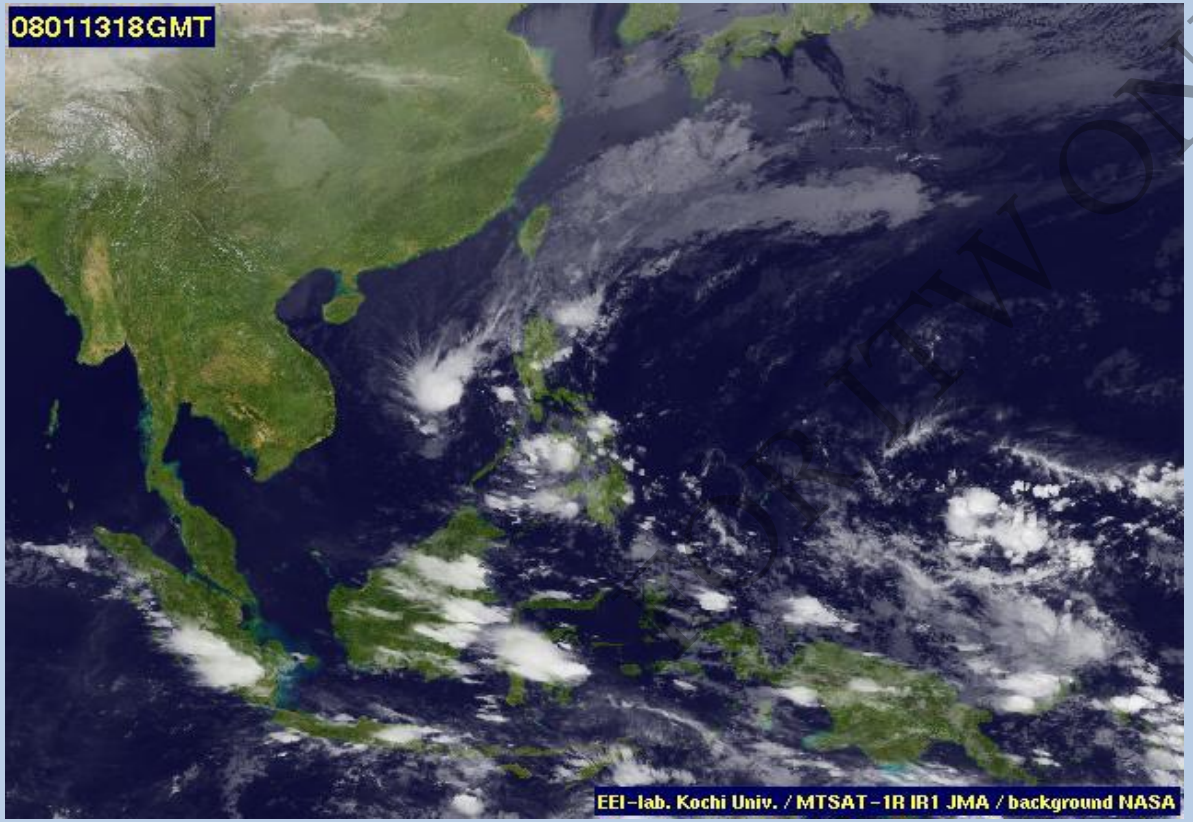
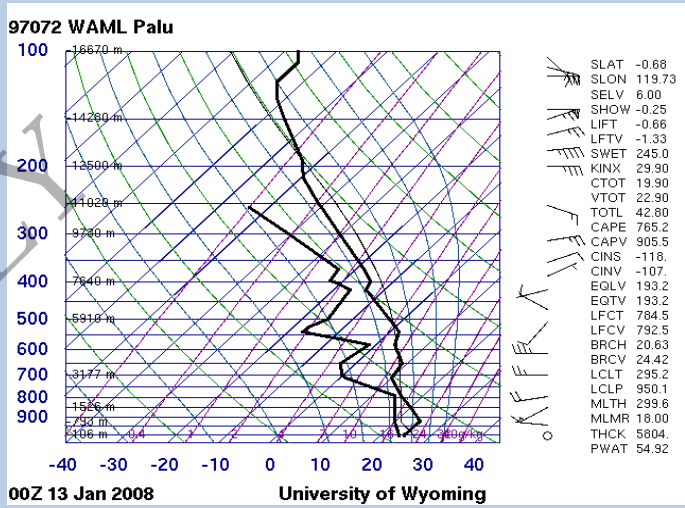
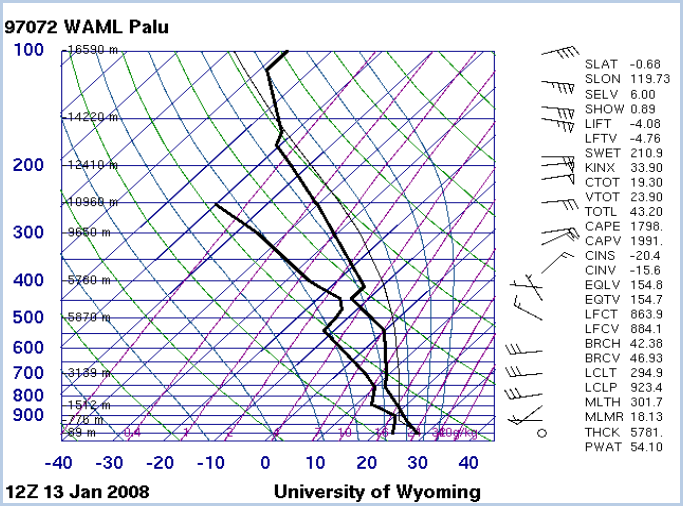
Analisis Faktor Atmosfer







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Sea Level Rise in Makassar City - Sulawesi

-Sea (Kelvin Wave, ARLINDO)
-Atmospheric aspect (Extreme weather)
-Geological aspect (Tectonic and Land Subsidence)

Year	Increase (m)
2050	1,14
2100	1,62

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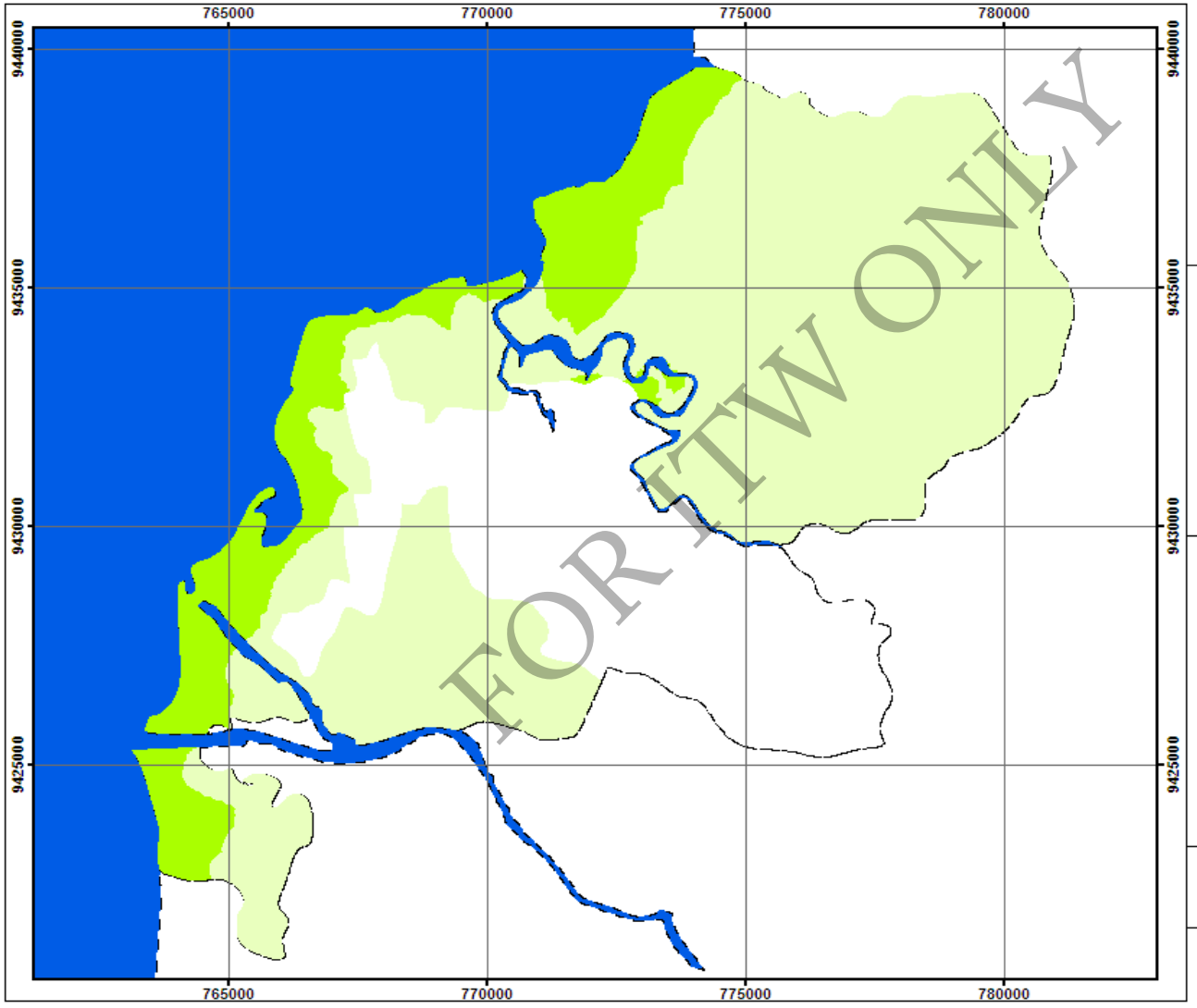
PETA BAHAYA KENAIKAN LAUT KOTA MAKASSAR TAHUN 2050



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N

0 1.000 2.000 4.000 6.000 Meters

Skala 1:110.000

Proyeksi : Universal Transverse Mercator
Grid : UTM
Datum Horizontal : WGS 1984
Zona : 50 S

LEGENDA

Sungai

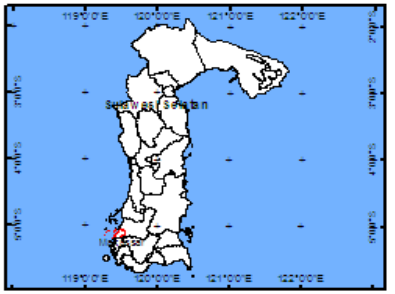
Batas Kota

Indeks

Bahaya Rendah

Bahaya Sedang

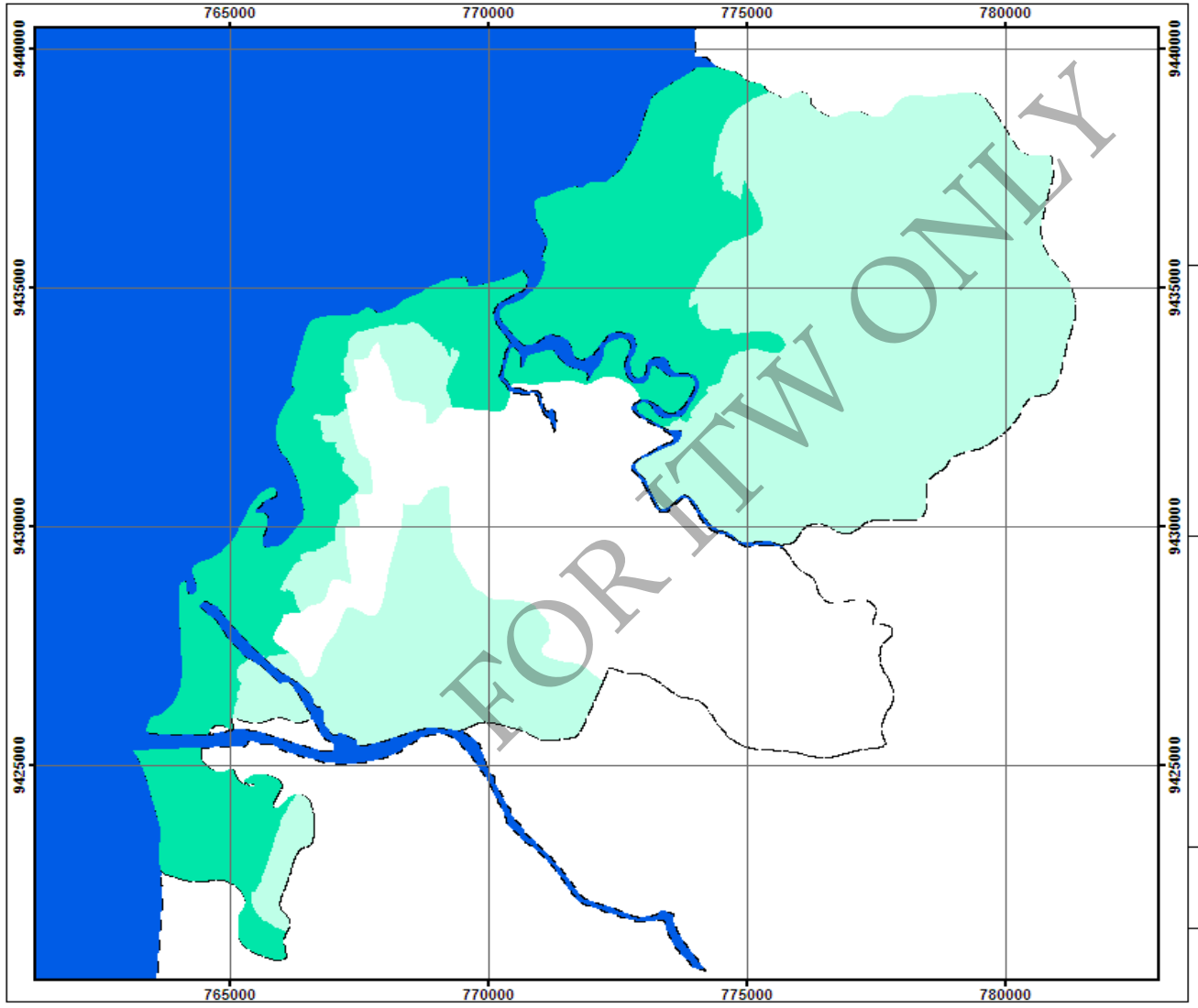
Keterangan : Kenaikan muka laut 0,7 m



Sumber : 1. Peta Tata Ruang Wilayah Kota Makassar Tahun 2016
2. Peta Rupa Bumi Indonesia

Badan Pengkajian dan Penerapan Teknologi

PETA BAHAYA KENAIKAN LAUT KOTA MAKASSAR TAHUN 2100



FOR ITW ONLY

N

0 1.000 2.000 4.000 6.000
Meters

Skala 1:110.000

Proyeksi : Universal Transverse Mercator
Grid : UTM
Datum Horizontal : WGS 1984
Zona : 50 S

LEGENDA

Sungai

Batas Kota

Indeks

Bahaya Rendah

Bahaya Sedang

Keterangan : Kenaikan muka laut 1,6 m

Sumber : 1. Peta Tata Ruang Wilayah Kota Makassar Tahun 2016
2. Peta Rupa Bumi Indonesia

Badan Pengkajian dan Penerapan Teknologi

Coastal Vulnerability

Physical Parameter (modified from Gornitz, 1991):

Social Economic Parameter (Szlafsztein, 2005):

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KERENTANAN PESISIR KOTA MAKASSAR

Physical Vulnerability (modifikasi Gornitz, 1991):

-Geomorphology

-Tidal average

-Average wave height

-Elevation

-Type of Lithology

-Changes in coastal line

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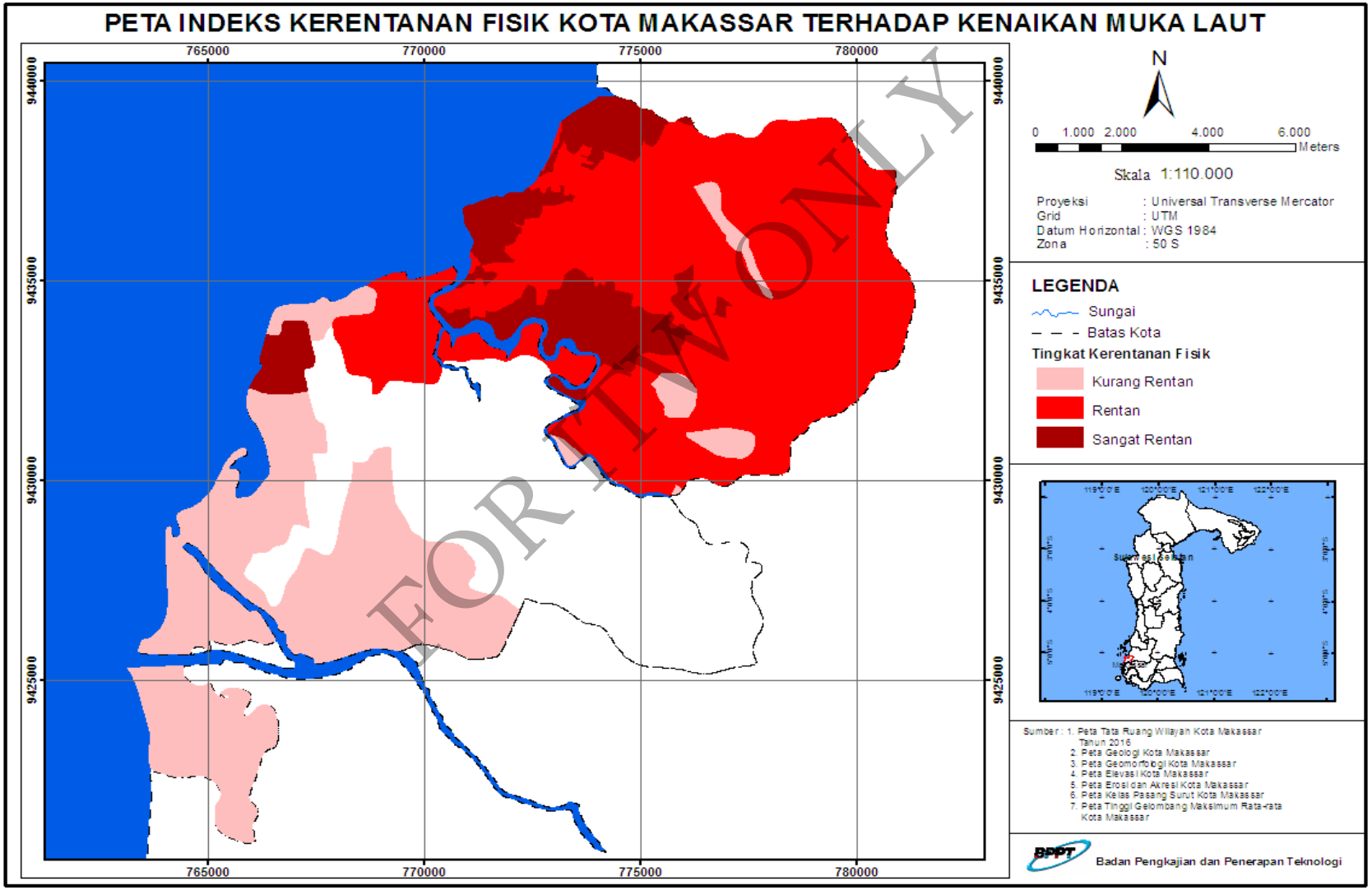
KERENTANAN FISIK KOTA MAKASSAR



KERENTANAN PESISIR KOTA MAKASSAR

Social Economic Parameter (Szlafzstein, 2005):
-Land Use
-Total Population Affected
-Level of Total Population Per Area
-Level of Poverty

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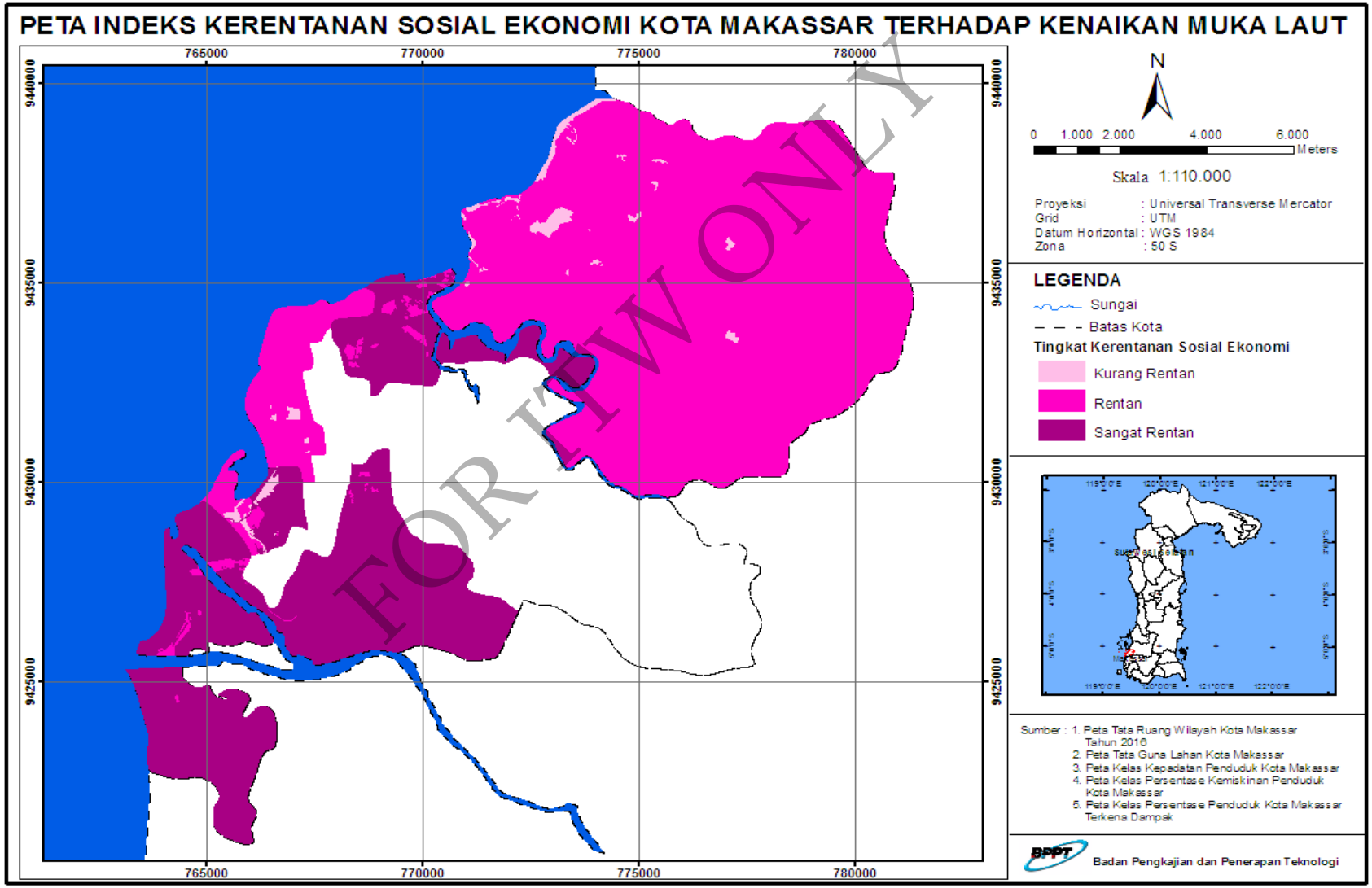
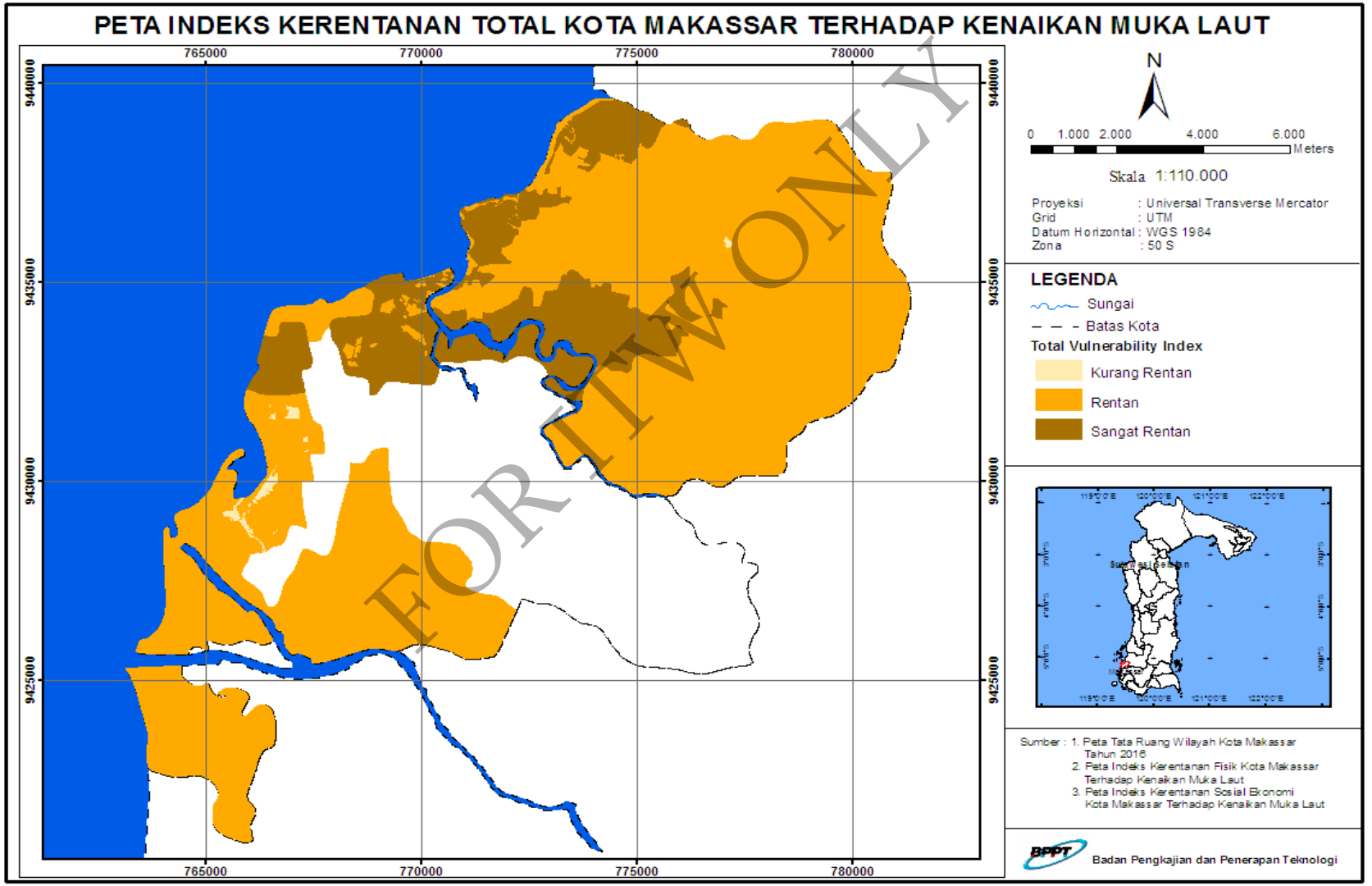
KERENTANAN SOSIAL EKONOMI KOTA MAKASSAR



KERENTANAN TOTAL KOTA MAKASSAR



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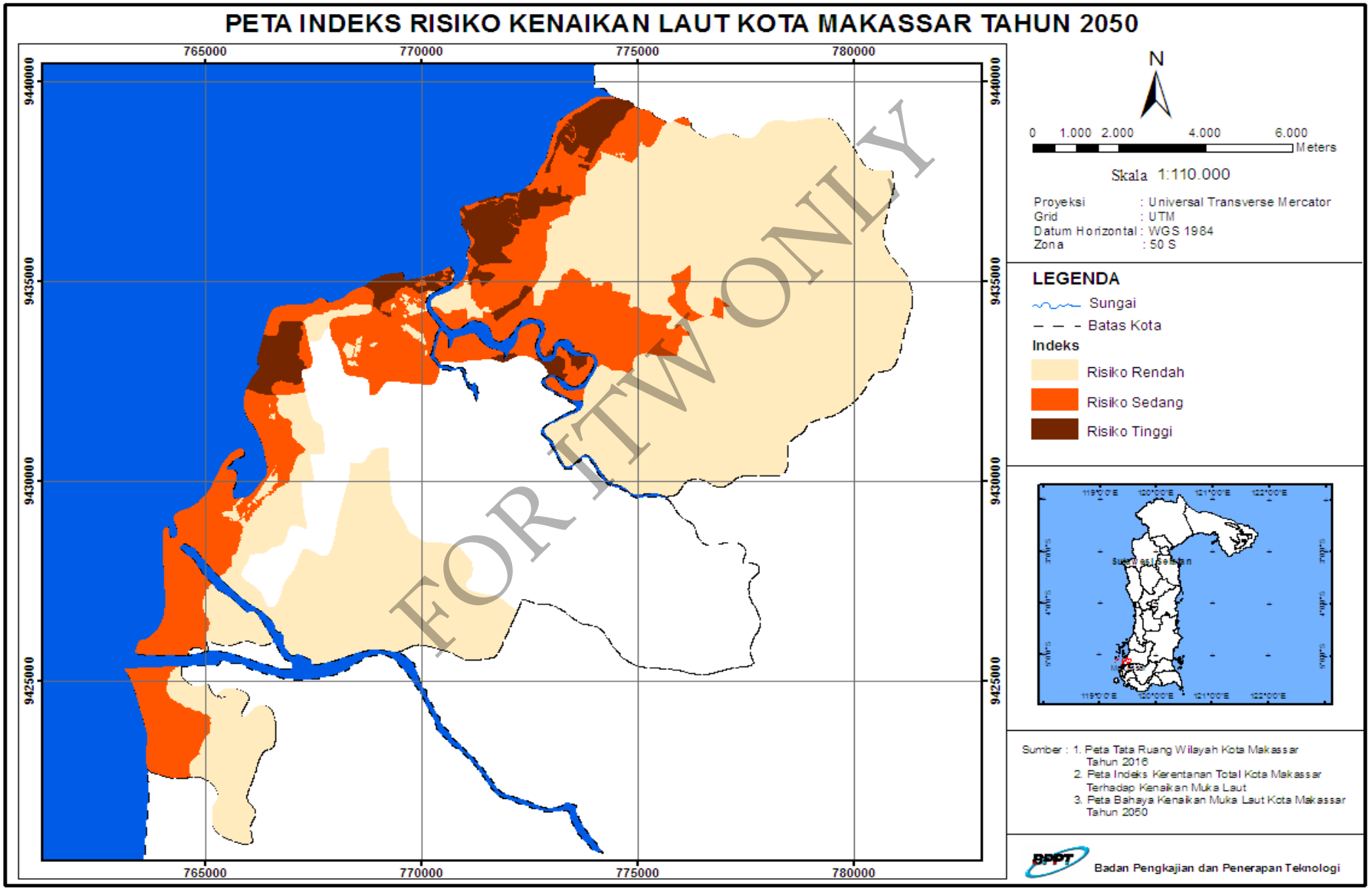
PETA INDEKS RISIKO KENAIKAN LAUT KOTA MAKASSAR TAHUN 2050



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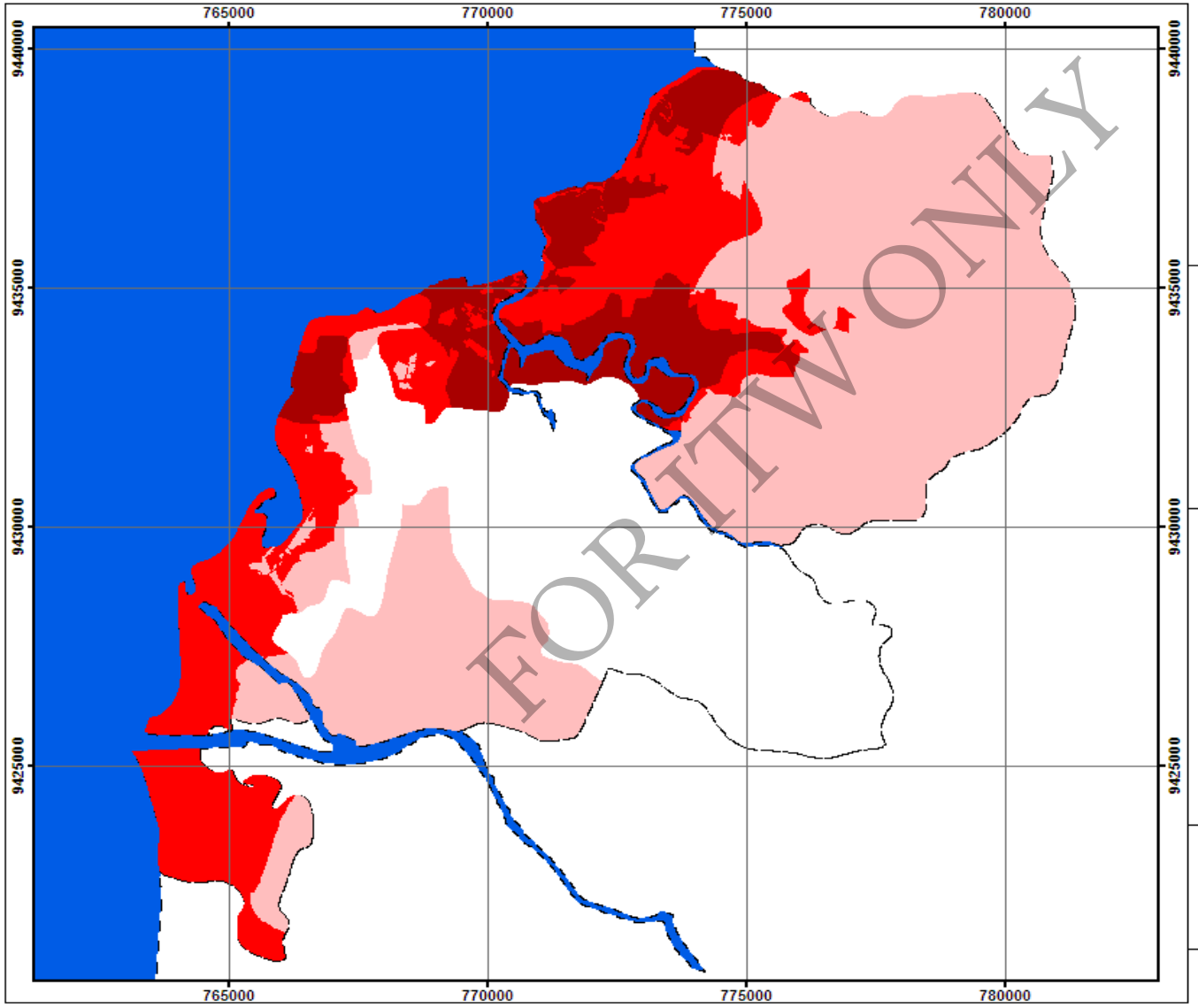
PETA INDEKS RISIKO BAHAYA TERHADAP KENAIKAN LAUT KOTA MAKASSAR TAHUN 2100



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N

0 1.000 2.000 4.000 6.000
Meters

Skala 1:110.000

Proyeksi : Universal Transverse Mercator
Grid : UTM
Datum Horizontal : WGS 1984
Zona : 50 S

LEGENDA

Sungai
Batas Kota

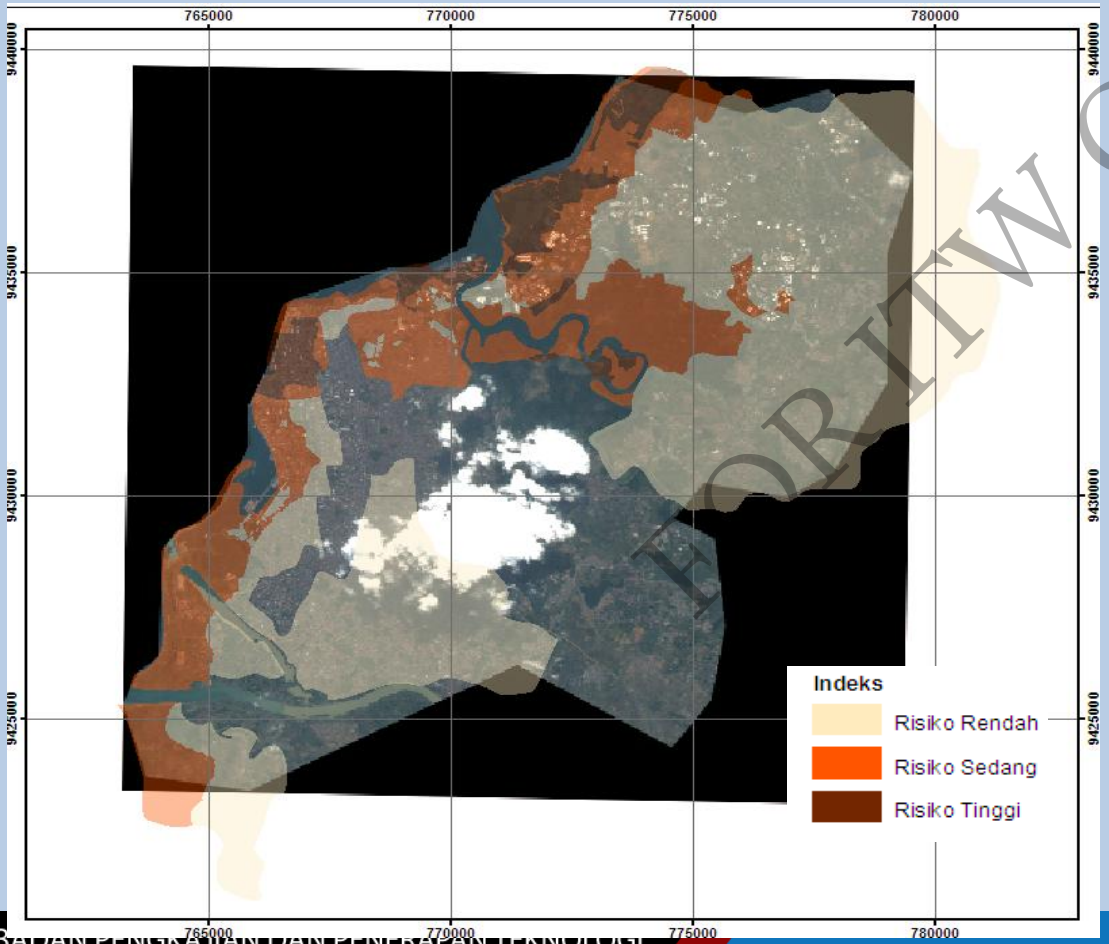
Indeks

Risiko rendah
Risiko Sedang
Risiko Tinggi

Sumber : 1. Peta Tata Ruang Wilayah Kota Makassar Tahun 2016
2. Peta Indeks Kerentanan Total Kota Makassar Terhadap Kenaikan Muka Laut
3. Peta Bahaya Kenaikan Muka Laut Kota Makassar Tahun 2100

Badan Pengkajian dan Penerapan Teknologi

RISK INDEX 2050	AREA (km^2)	HECTARE
Risiko Rendah	83,14	8313,57
Risiko Sedang	29,474	2946,98
Risiko Tinggi	6,794	678,99



2050

DISTRICT	HIGH RISK (km^2)	AREA (Hektar)
BIRINGKANAYA	1,185	118,551
MARISO		
TALLO	1,180	117,945
TAMALANREA	2,889	288,993
TAMALATE		
UJUNGPANDANG		
UJUNGTANAH		
WAJO	1,536	153,504

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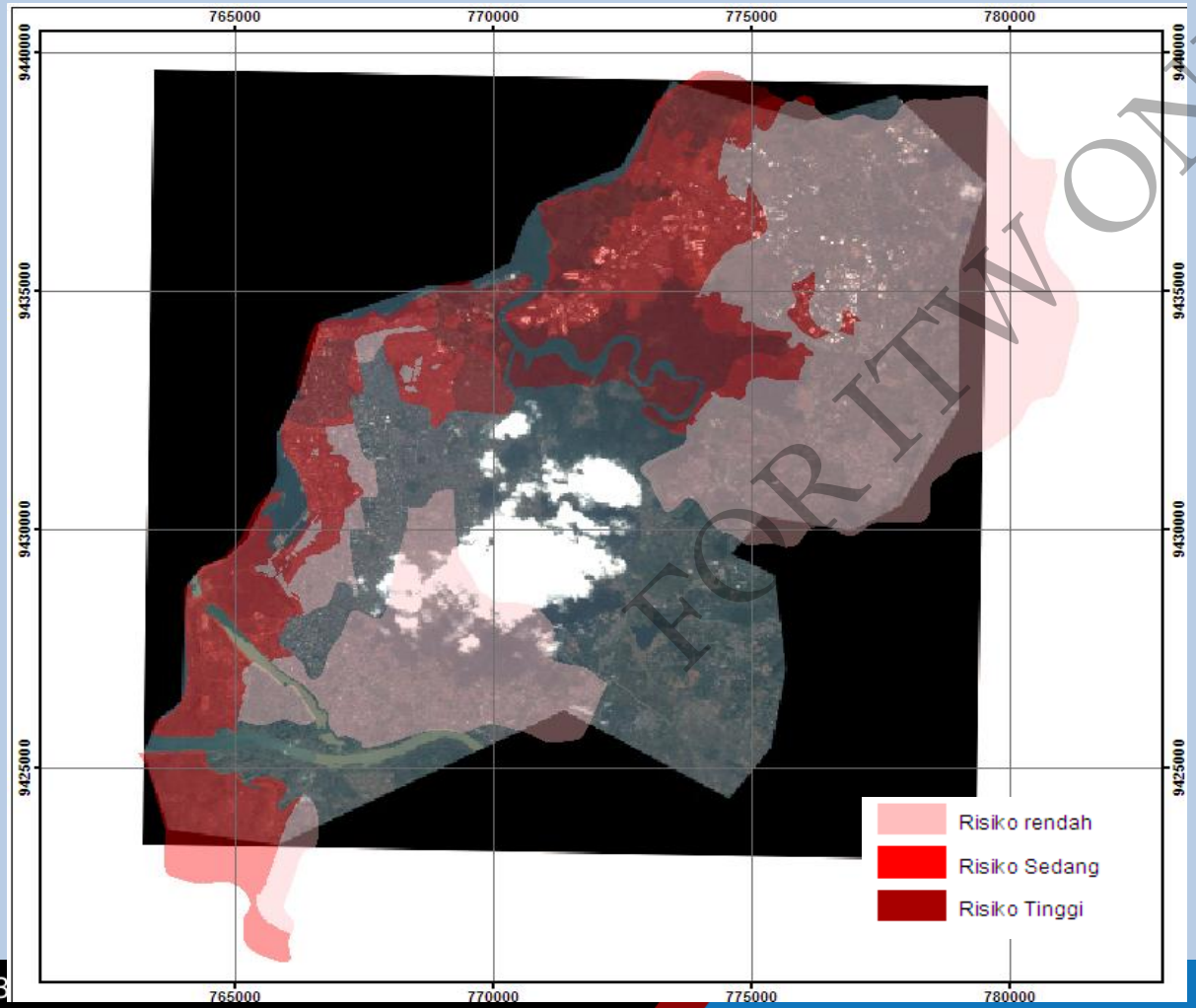
RISK INDEX 2100	AREA (km^2)	Hectar e
Risiko Rendah	72,8100	7280,9200
Risiko Sedang	30,9750	3097,2430
Risiko Tinggi	15,6130	1561,3720



2100

DISTRICT	HIGH RISK (km^2)	AREA (Hectare)
BIRINGKANAYA	1,726	172,640
MARISO		
TALLO	4,873	487,432
TAMALANREA	7,348	734,771
TAMALATE		
UJUNGPANDANG		
UJUNGTANAH		
WAJO	1,666	166,529

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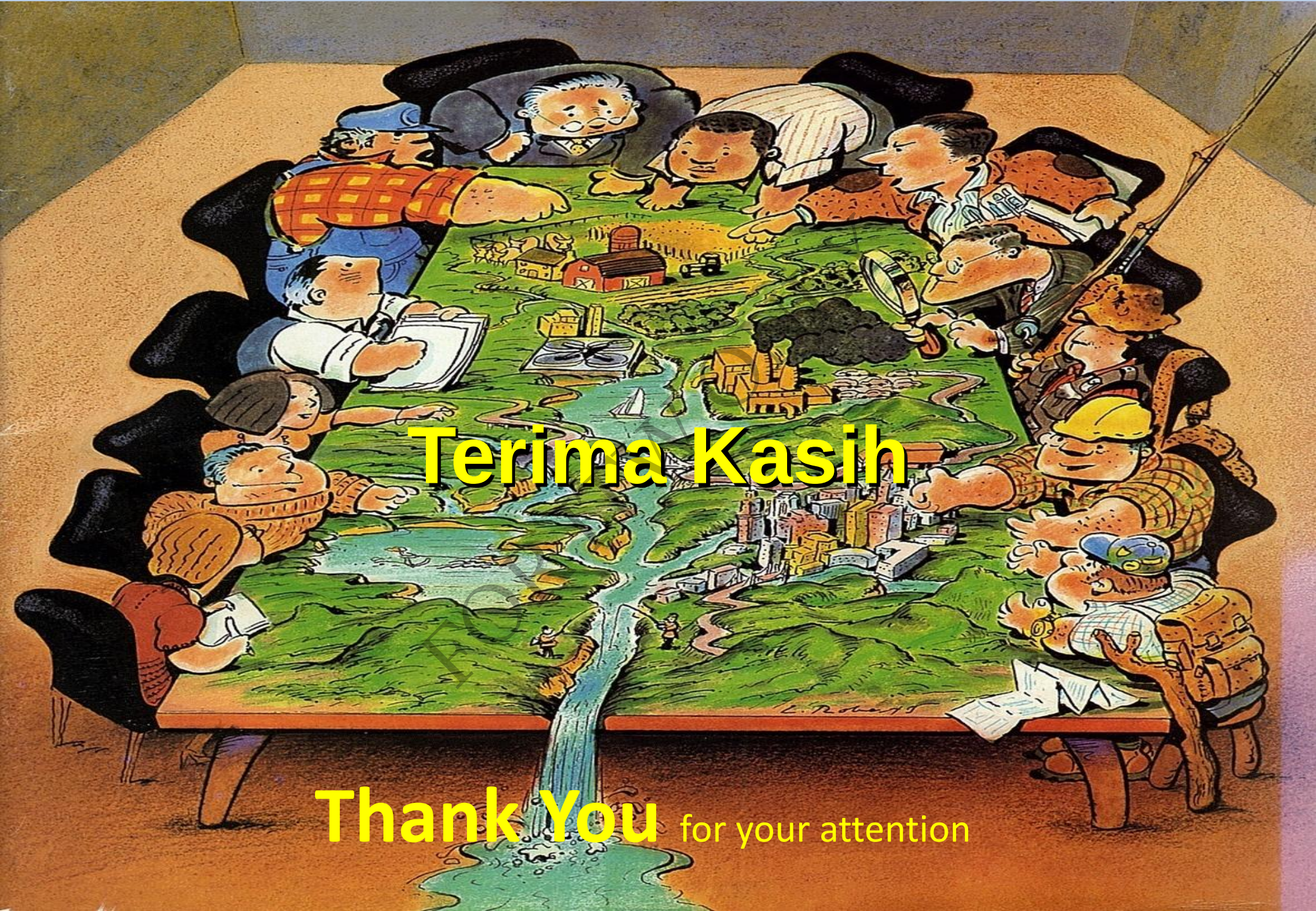
Terima Kasih
Thank You for your attention

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