



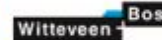
Assessment and Roadmap Towards Adapting and Mitigating Land Subsidence in Central Java Province



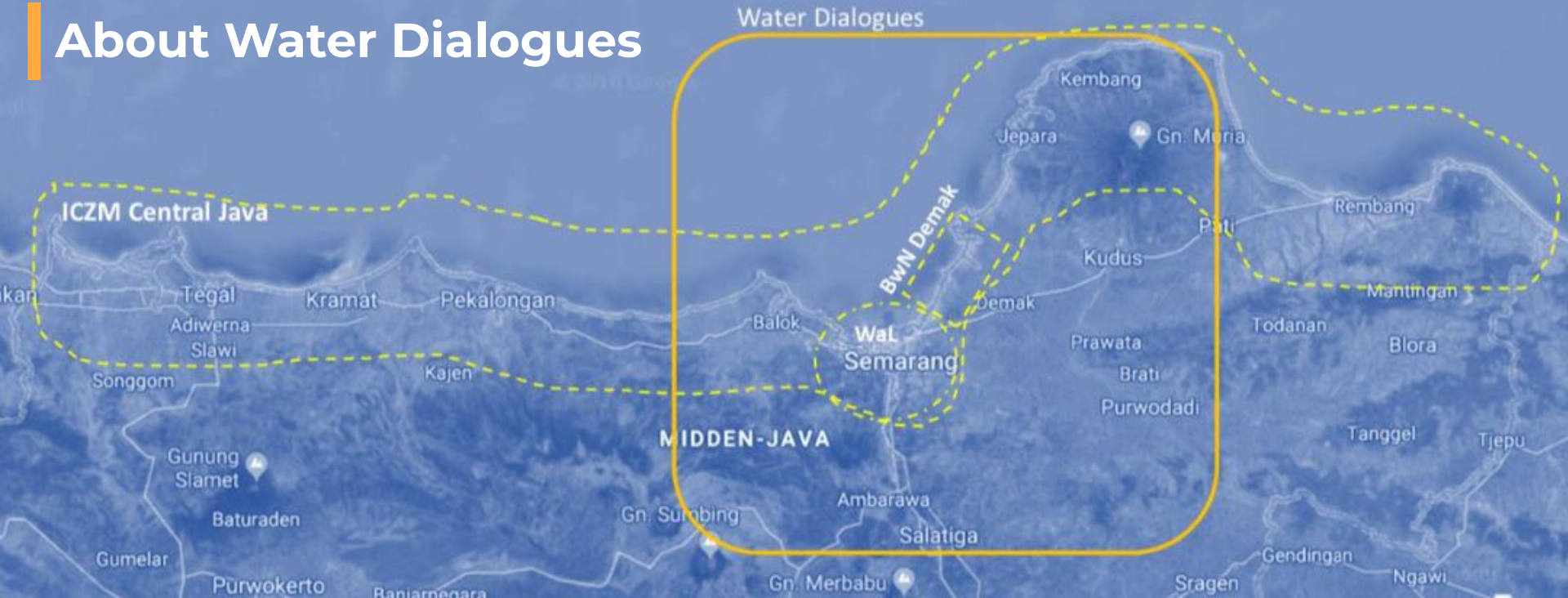
5 March 2021



**KOTA
KITA**
A CITY FOR ALL



About Water Dialogues



The Water Dialogue aims to **address land subsidence in Semarang & Demak's coastal zone through the formulation of a roadmap with all actors in the wider watershed**

What have been done so far

Series of Interviews
with local stakeholders

Field visits to the areas
with land subsidence

**Focus Group
Discussion (FGD) 1** with
knowledge partners

**Development of
Roadmap**
adaptation and mitigation
to land subsidence

FGD 2 verification and
next steps

Final **Dissemination
Workshop**

Outline of the Roadmap Document

CHAPTER 1: Introduction

CHAPTER 2: Alignment and Review of the Current Regulatory Framework

CHAPTER 3: Land Subsidence in Semarang and Demak

3.1 Overview of Land Subsidence Issue in Central Java

3.2 Overview: Land subsidence in Semarang and Demak

3.3 Economic Assessment of Subsidence Impact

CHAPTER 4: Institutional Framework

CHAPTER 5: Roadmap of Strategies

An aerial photograph showing a village with several houses with red-tiled roofs, surrounded by dense green trees. The village is situated on a narrow strip of land, with a wide, muddy river or floodplain on either side. The water is a light brown color, indicating it might be carrying sediment. A road or path runs through the village. In the foreground, there is a white text box with a blue border and a blue vertical bar on the left side. The text inside the box reads "Alignment and Review of Current Regulatory Framework".

Alignment and Review of Current Regulatory Framework

National Roadmap on Land Subsidence



Peta Jalan (*Road Map*) Mitigasi dan Adaptasi Amblesan (Subsiden) Tanah di Dataran Rendah Pesisir

Kementerian Koordinator Bidang Kemanitman Republik Indonesia
Yayasan Lahan Basah (Wetlands International Indonesia)
Institut Teknologi Bandung (ITB)



- Working Group for the development of National roadmap has been established in December 2018.
- The National Roadmap on Mitigation and Adaptation to Land Subsidence has been developed and launched (September 2019).
- The roadmap on adaptation and mitigation to land subsidence at the National Level will be followed-up at the local level.



An aerial photograph showing a flooded area. In the center, there is a cluster of houses with red-tiled roofs, surrounded by green trees. The houses are partially submerged in muddy, brown water. To the right, there is a large, flat, sandy area that appears to be a dry riverbed or a flooded field. The overall scene depicts the impact of land subsidence and flooding in a rural area.

Land Subsidence in Semarang and Demak

Overview and Impact Assessment

3.1 Overview of Land Subsidence in Central Java

3.2 Overview: Land subsidence in Semarang and Demak

3.3 Economic Assessment of Subsidence Impact

Causes of Land Subsidence

Natural consolidation

Tectonic movement

Natural

No mitigation potential, only adaptation

Structural load

Groundwater extraction

Anthropogenic

Limited mitigation potential

High mitigation potential

Extent of subsidence

Rates up 19 cm/year

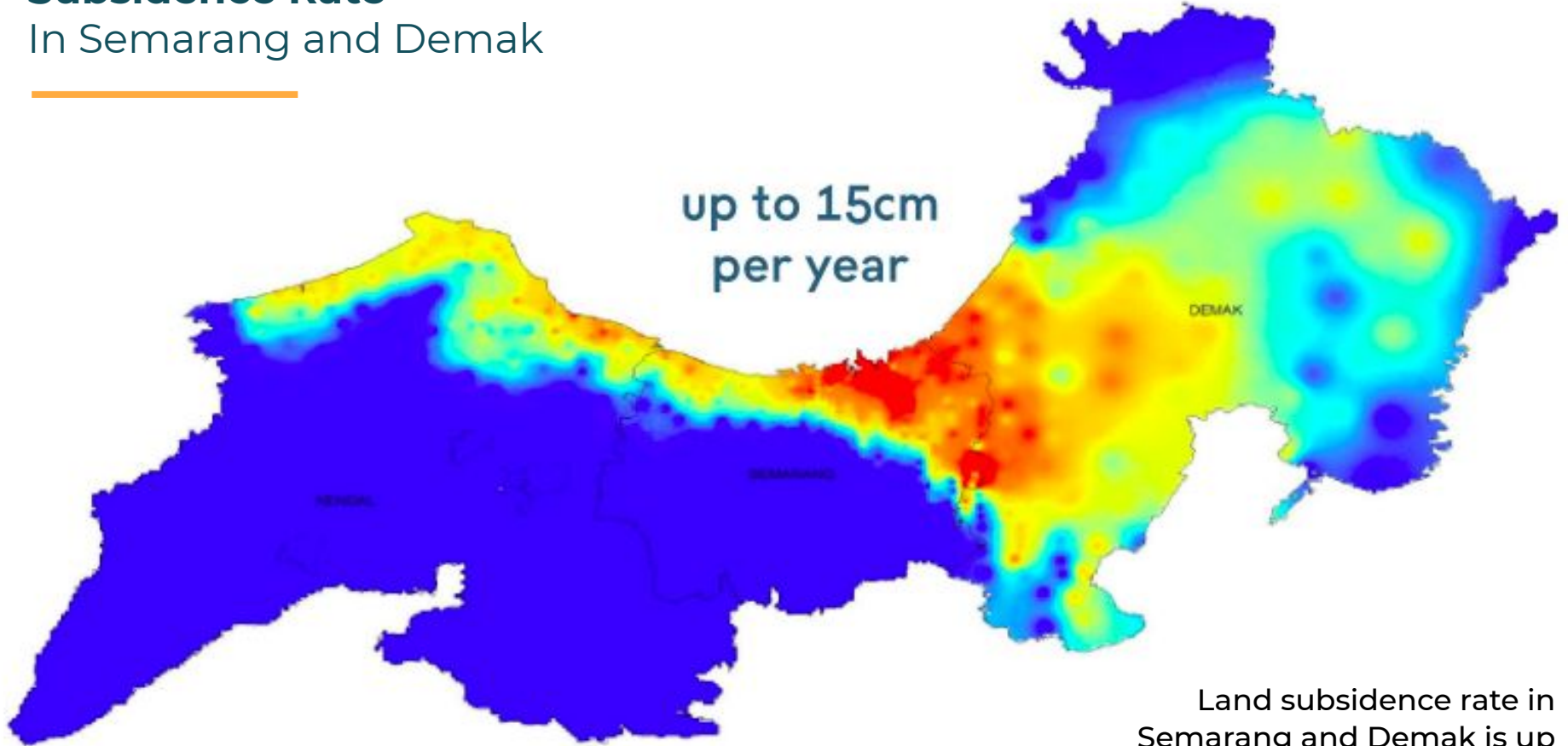
Spatial and temporal variation

NE Semarang highest rates

Overlaps with industry

Overlaps with alluvial deposits

Subsidence Rate In Semarang and Demak



Land subsidence rate in Semarang and Demak is up to 15 cm per year

Source: Andreas, Heri

Impacts of Land Subsidence

No	City / Regency in North Coast of Central Java	Total area with sedimentation (ha)	Total area with coastal abrasion (ha)	Total area with coastal flooding (rob) (hektar)
1	Pekalongan	427,5	77,3	4.500,8
2	Batang	-	-	11,0
3	Kendal	1.005,8	317,4	258,9
4	Semarang	318,7	342,6	1.157,8
5	Demak	-	-	3.221,0

Economic Impact Assessment: Methodology

Business as Usual
(100% of current
subsidence rate)

In BAU, the subsidence rate will remain constant over time. Currently planned measures that address groundwater extraction are assumed to either be ineffective in significantly reducing the subsidence rate or will not take effect until after 2040.

Scenario A (50%
of current
subsidence rate)

The subsidence rate will remain constant in the first 10 years (2020-2030), and then be reduced by 50% as a result of efforts to mitigate subsidence.

Scenario B (25%
of current
subsidence rate)

We assume that in scenario B the subsidence rate will remain constant in the first 10 years (2020-2030), and then reduce by 75% as a result of efforts to mitigate subsidence.

Economic Impact Assessment: Result

Effect	Damage in Semarang (billion IDR)			Damage in Demak (billion IDR)		
	A	B	BAU	A	B	BAU
Direct						
Increased road maintenance	1346	1180	1677	798	700	994
Increased arterial road maintenance	764	670	951	549	481	684
Damage to buildings	53	47	66	5	4	66
Damage to other infrastructure	PM	PM	PM	PM	PM	PM
Indirect						
Land Loss	55753	13764	76168	27157	23263	37166
Increased Coastal Flood risk	300	348	248	146	181	142
Increased pluvial and fluvial flood risk	PM	PM	PM	PM	PM	PM
Reduced attractiveness of business climate; lower agricultural yields	PM	PM	PM	PM	PM	PM
Lower quality of life population	PM	PM	PM	PM	PM	PM
Total (present value in billion IDR)	58,216	16,009	79,110	28,655	24,629	39,052

With Scenario B, more than 78 Trillion IDR of avoided losses can be achieved by 2040

Current Measures Addressing Land Subsidence in Semarang and Demak

- **Projects addressing water resource and flood management;**
 - Water resource planning (Pola Rencana Sumber Daya Air)
 - Construction of dikes and a polder system along floodway canal and shoreline (van Beek, Letitre, Hadiyanto, & Sudarno, 2019)
 - Construction of a pumping station (Andreas et al., 2017)
 - Construction of floodway to reduce fluvial flood hazard
 - Drainage masterplan in Semarang
 - Elevation of roads and bridges
 - Mangrove restoration
- **Projects addressing sustainable land use**
 - Land arrangement models Sukorejo
 - Coastal planning and management (Marfai & King, 2008)
- **Projects addressing subsidence:**
 - Drinking water master plan



Current Institutional Framework in Central Java Province

Overview of Current Institutional Framework Regarding the Land Subsidence

Current Conditions	Problems/GAP	Goals
National Government		
Has the authority to formulate policies and programs at the national scale	<ul style="list-style-type: none">· Land subsidence has not been part of the disaster category in Indonesia.· A national program such as PAMSIMAS (a national program of water provision that using groundwater) contributes to land subsidence.	The establishment of policies and programs that encourage mitigation and adaptation of land subsidence in Provincial and City/ Regency.
Already have a working group on mitigation and adaptation of land subsidence by the end of 2020	The role of the working group in implementing mitigation actions and adaptation of land subsidence has not been optimal due to the budgeting mechanism.	The working group for mitigation and adaptation of land subsidence at the national level could be a role model for local governments.

Current Conditions	Problems/GAP	Goals
Central Java Province Government	<ul style="list-style-type: none"> · An institution that specifically handles land subsidence which is integrated among the national, provincial, and city/district governments has not been established yet. · The comprehensive, as well as integrated programs and policies (across regions and sectors) regarding the land subsidence, has not been developed yet. · Lack of involvement and active participation of more integrated stakeholders, both government and non-government. 	<ul style="list-style-type: none"> · An authorized institution for the mitigation and adaptation of land subsidence with a clear legal and policy basis is established. · The compilation of integrated and comprehensive programs for the mitigation and adaptation of land subsidence with clear regulations and budgeting mechanisms. · The establishment of an inclusive collaboration of all stakeholders to optimize efforts to mitigate and adapt to land subsidence in Central Java Province.
<p>Has the authorities related to:</p> <ul style="list-style-type: none"> · Groundwater management in Central Java Province (Regulation of Central Java Province No.3 / 2018 concerning Groundwater Management) · Management of coastal areas as far as 0-12 miles from the shoreline (Law No. 1/2014 concerning on Amendments to Law No. 27/2007 concerning on Management of Coastal Areas and Small Islands) 		
<ul style="list-style-type: none"> · The institutional framework for mitigation and adaptation of land subsidence has not been established yet. The existing institutions carry out the programs related to land subsidence sporadically, based on the main functions and tasks of each stakeholder · The stakeholders involved in handling land subsidence issues are still dominated by the government and academia. 		

Current Conditions	Problems/GAP	Goals
<p style="text-align: center;">City/ Regency Government</p>	<ul style="list-style-type: none"> · An institution that specifically handles land subsidence which is integrated among the national, provincial, and city/district governments has not been established yet. · The comprehensive, as well as integrated programs and policies (across regions and sectors) regarding the land subsidence, has not been developed yet. · Lack of involvement and active participation of more integrated stakeholders, both government and non-government. 	<ul style="list-style-type: none"> · An authorized institution for the mitigation and adaptation of land subsidence with a clear legal and policy basis is established. · The compilation of integrated and comprehensive programs for the mitigation and adaptation of land subsidence with clear regulations and budgeting mechanisms. · The establishment of an inclusive collaboration of all stakeholders to optimize efforts to mitigate and adapt to land subsidence in Central Java Province.
<p>Has the authority to develop the program as well as land utilization and management at City/ Regency level.</p>		
<ul style="list-style-type: none"> · The institutionalization for mitigation and adaptation of land subsidence has not been established yet. The existing institutions carry out the programs related to land subsidence sporadically, based on the main functions and tasks of each stakeholder · The stakeholders involved in handling land subsidence issues are still dominated by the government and academia. 		

The identification of the institutional framework in Central Java Province related to the mitigation and adaptation of land subsidence is identified through two (2) aspects, namely authority as well as main tasks and functions (*tupoksi*).

1. **Authority**

- The management of lowland and coastal areas cannot be separated by jurisdiction aspect.
- Central, Provincial, and Local Government have different authority regarding to land subsidence

2. **Main Duties and Functions (Tupoksi)**

- The coordination mechanism for land subsidence in Central Java is under the authority of the Central Java Provincial Government. The following are the key institutions that should be involved.

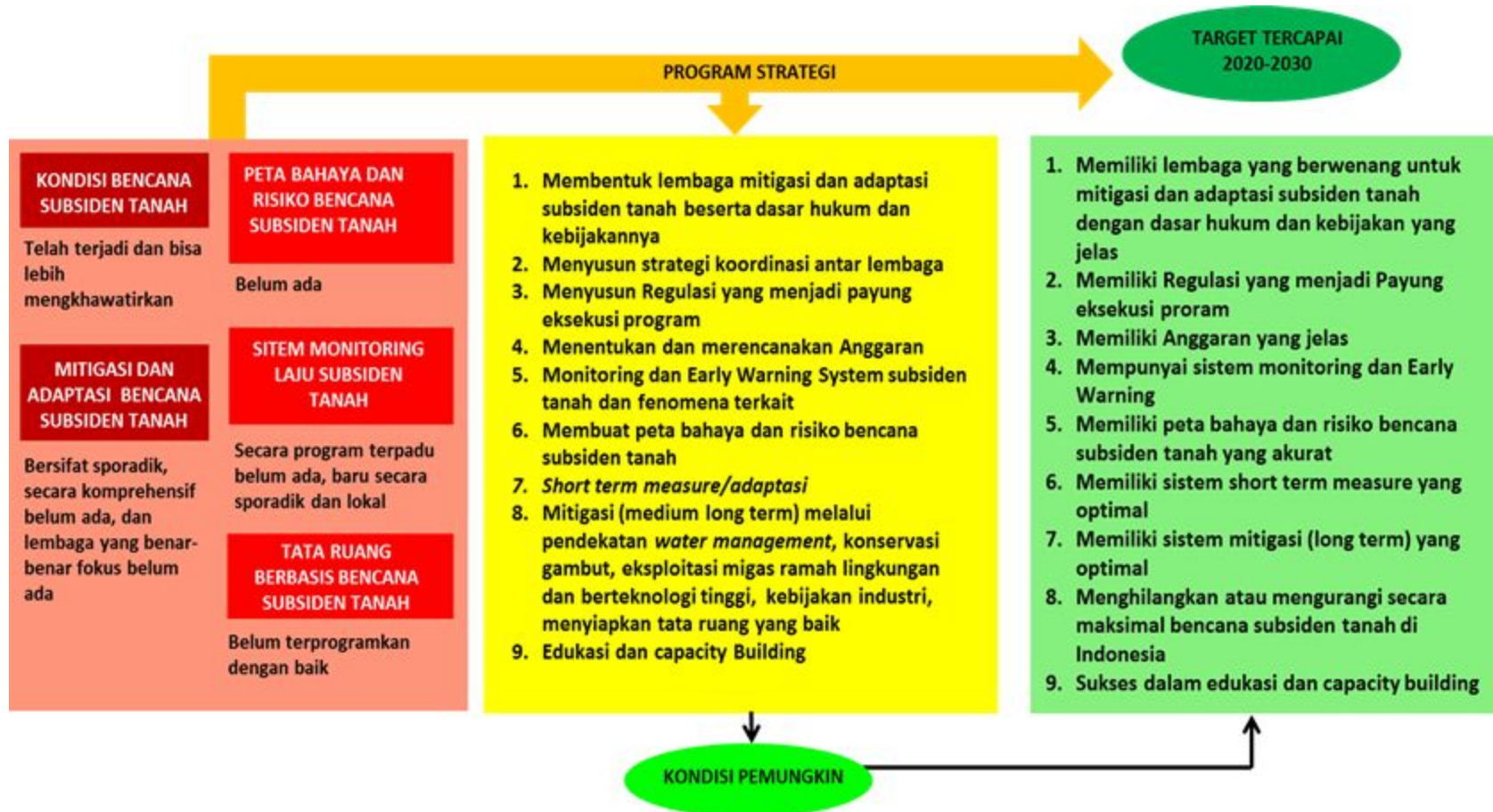
<p>Central Java Province</p> <ol style="list-style-type: none">1. Public Works Agency of Water Resources and Spatial Planning (PUSDATARU)2. Development Planning Agency (BAPPEDA)3. Energy and Mineral Resources Agency (ESDM)4. Disaster Management Agency (BPBD)	<p>City / Regency Governments in Coastal Area of Central Java Province:</p> <p>Local government that have main duties and functions in the areas of spatial planning and water management such as BAPPEDA, Spatial Planning Agency, and Public Works</p>
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An aerial photograph showing a village with several buildings and trees surrounded by floodwaters. A road or path runs through the village, and some boats are visible in the water. The text 'Roadmap of Strategies' is overlaid on the image in a white box with a blue border, and a vertical orange bar is on the left side.

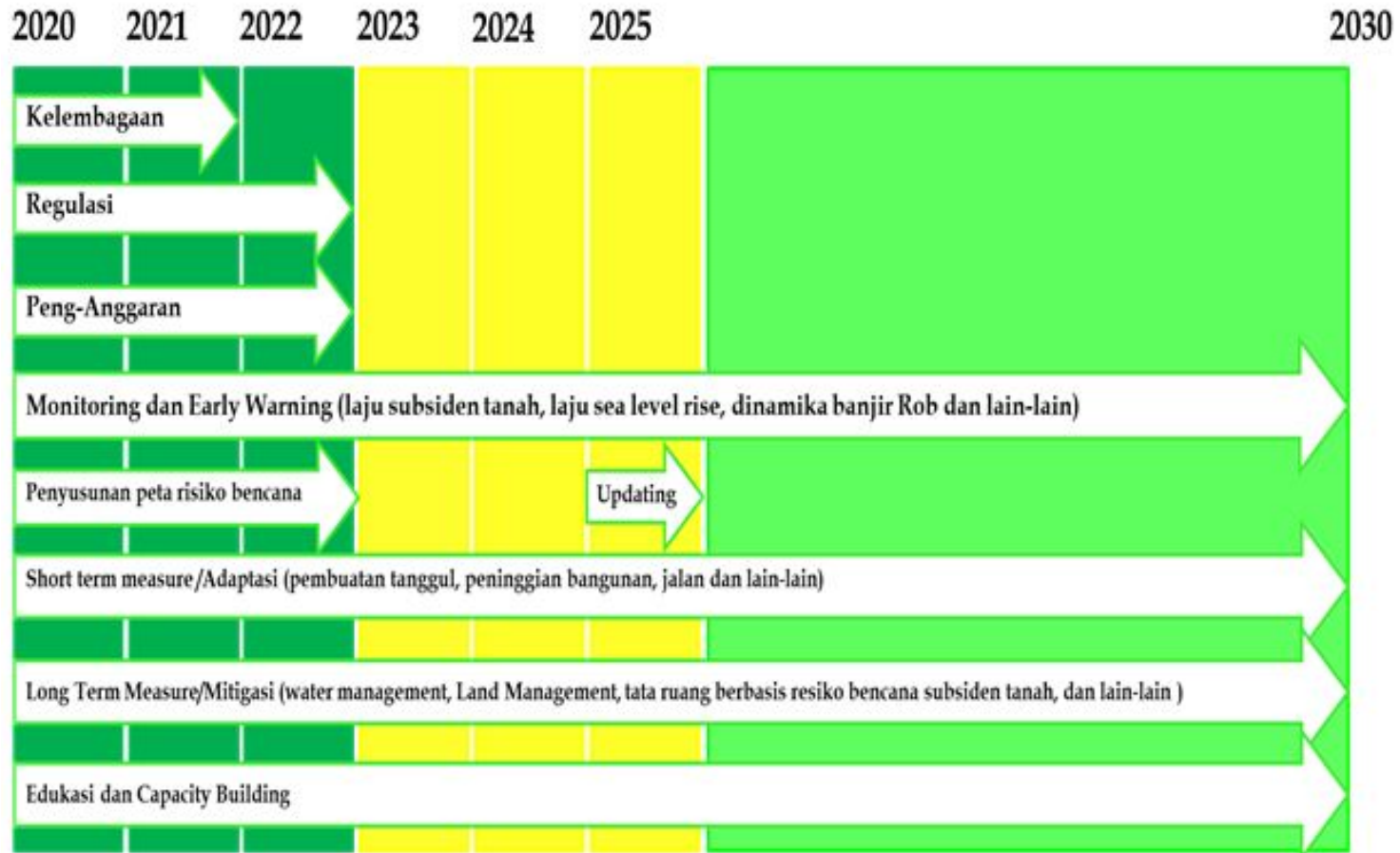
Roadmap of Strategies

Roadmap of Strategies

1. Establishment of a land subsidence adaptation and mitigation **institution / governance platform**,
2. Draft necessary **regulations**,
3. Create **programs and budget**,
4. Develop **monitoring system**,
5. Develop **early warning system**,
6. Create **land subsidence disaster risk and hazard maps**,
7. Implement **adaptation measures** (short term measures),
8. Implement **mitigation measures** (long term measures),
9. **Education and capacity building.**

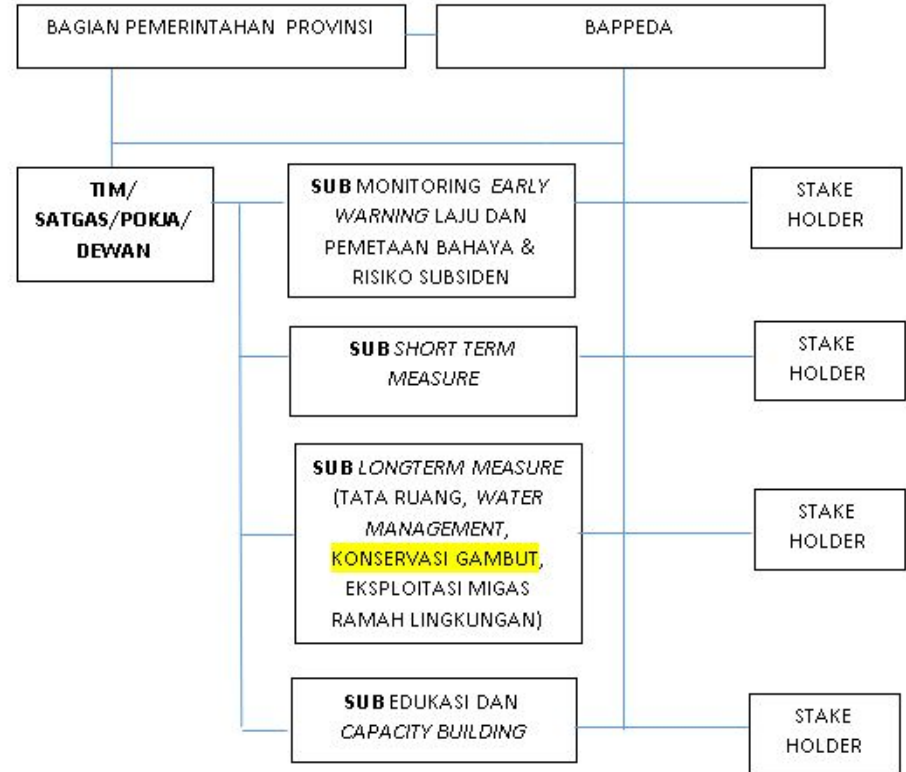


Roadmap of Strategies



1. Establishment of a land subsidence adaptation and mitigation institution / governance platform

- Institutional formation is a crucial first step since land subsidence adaptation and mitigation activities will be under the responsibility and authority of the institution that will be formed.
- Central Java Province's BAPPEDA can, accordingly, function as the coordinator of the institution for the adaptation and mitigation of land subsidence and relevant disasters in the Central Java area.
- Subsequently, the institution established can be in the form of a Centre, Board, Working Group, or any other forms considered to have a strong and effective role.



2. Regulations

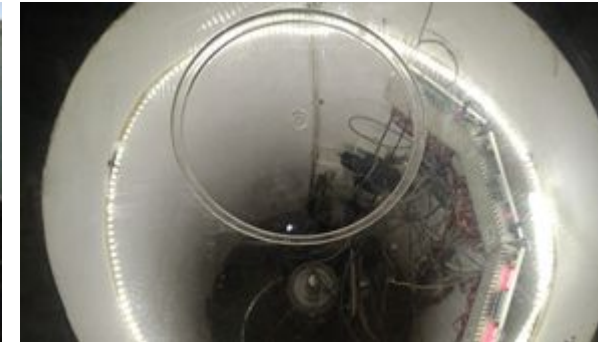
- To this day there has yet been any comprehensive regulation pertaining to land subsidence issues at both central and regional levels.
- Regulation is an absolute factor in creating programs and budgeting.
- Without regulations as a legal basis, programs and budget are unable to implement.
- The first regulation that must be given due attention is the effort of including land subsidence in the revision of Law 24/2007 on Disaster Management, which is currently being revised.
- Once the land subsidence nomenclature is included in the disaster category, it will be easier for policymakers to create programs and budgets relating to land subsidence. Subsequently, once normative regulation is in place, it should be followed up by drafting technical regulations concerning land subsidence, including in Regional Regulations.

3. Develop **program and budget**

- In Central Java, programs for land subsidence disaster risk mapping, early warning, monitoring, and others remain unavailable.
- Accordingly, once the regulation drafting process is done, activities in creating programs and budget must be conducted immediately.

4. Develop **monitoring system of land subsidence**

- Data and information obtained from early warning and monitoring results serve as input parameters in creating a land subsidence risk map.
- Without mapping, early warning, and monitoring systems, any effort to properly understand the phenomenon of land subsidence will be a difficult undertaking.



Documentation of land subsidence monitoring operation by using GNSS in the northern coast of Java and land subsidence monitoring device in the city of Shanghai.

5. Developing an **Early Warning System**

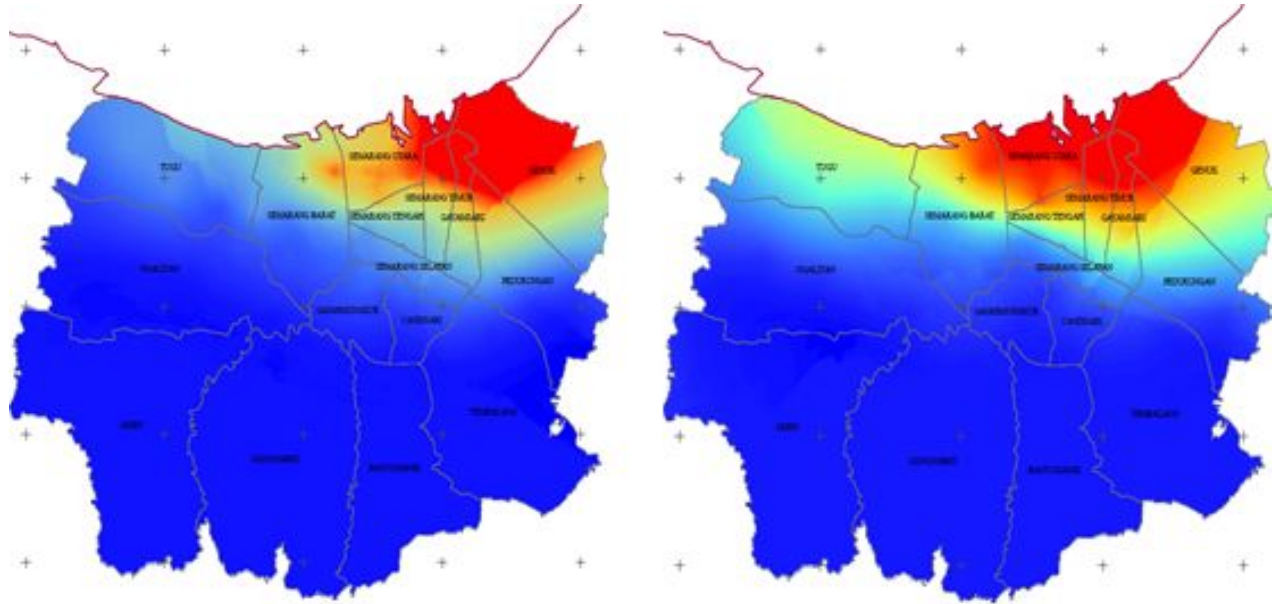
- An early warning system (EWS) should be developed in order to understand the phenomenon of land subsidence and the disaster potential it may cause.
- The system is a development of the monitoring system that operates in real time.
- Data and information acquired from the early warning and monitoring results serve as input parameters in creating a land subsidence risk map.



Illustration of land subsidence disaster risk early warning system currently developed in Jakarta. In the future, this system is expected to be developed in Central Java areas experiencing land subsidence.

6. Development of Land Subsidence Risk Map

- Data and information obtained from early warning and monitoring results serve as input parameters in creating a land subsidence risk map.
- Mapping will, spatially, show which areas are experiencing land subsidence and its disaster potential.
- Land subsidence risk map and analysis are, accordingly, used to, effectively and efficiently, plan and implement land subsidence adaptation and mitigation efforts in the Central Java area.



Examples of land subsidence hazard map (in the Semarang area) that can be used to create and analyze land subsidence risks

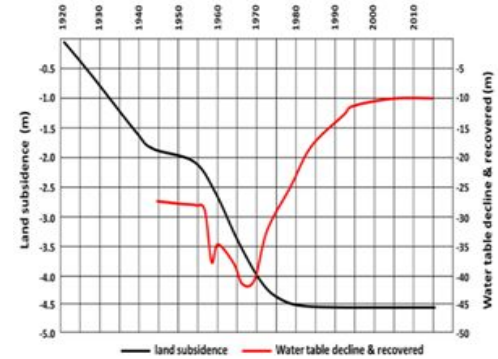
7. Implementing **Adaptation Measures** (Short Term Measure)

- Adaptation measures or short term measures such as constructing embankments, elevating infrastructure, and so forth must, immediately and constantly, be done.
- As of current, these efforts have been carried out in Semarang, Pekalongan, and some areas of Demak.
- Adaptation is categorized as a short term measure as it is carried out for a short period of time, wherein its effectiveness will wane along with the passing of time.
- Examples of cases in Semarang, Demak, and Pekalongan show that several infrastructures, including buildings, have been elevated two to three times, some even more. This means that adaptation efforts are merely temporary.

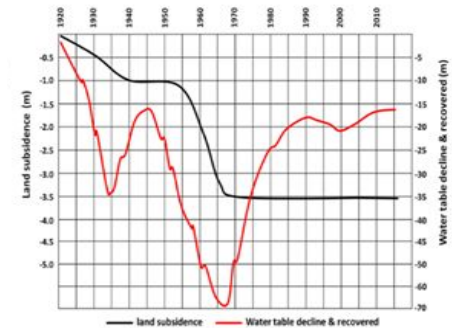


8. Implementing **Mitigation Measures** (Long Term Measure)

- Land subsidence can be stopped by managing the water and the land.
- Water and land management has been proven as a solution for land subsidence disaster abroad. This is done by halting the extraction of groundwater, wherein water management was previously carried out by building surface water infrastructure and paying attention to land management.
- Such land subsidence disaster mitigation efforts must be implemented for the Central Java area and articulated into more detailed actions.
- Mitigation efforts must begin today or it should be effectively implemented by next year at the latest.



(a)



(b)

9. Education and Capacity Building

- The phenomenon of land subsidence along with the impacts it may cause up to the disaster stage should not only be known by a few number of people, or even just the government.
- All elements should understand and know about information relating to the phenomenon of land subsidence because the implementation of adaptation and mitigation efforts will eventually involve all elements including the community.
- The success of adaptation and mitigation will depend on the understanding that all parties have. This is why education and capacity building play a part in the roadmap that is of no less importance and should be implemented within the arranged timeline.

An aerial photograph of a village with several houses and trees, surrounded by a large body of brown, muddy water. The houses have reddish-brown roofs. A road or path runs through the village. The water is very high, reaching the roofs of some buildings. The overall scene suggests a flood or a large-scale water management project.

NEXT STEPS

Next Steps

Series of Interviews
with local stakeholders

Field visits to the areas
with land subsidence

**Focus Group
Discussion (FGD) 1** with
knowledge partners

**Development of
Roadmap**
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Thank you - Terimakasih