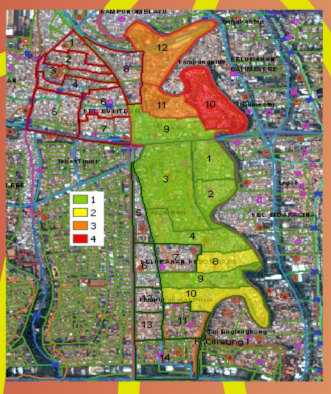
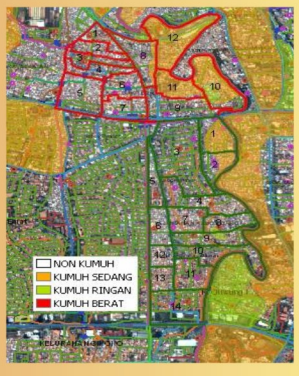
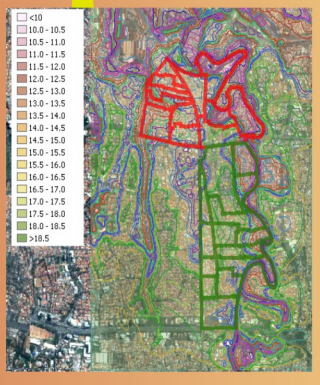
ANALYZES REPORT

RISK AND HAZARD ASSESSMENT FOR JAKARTA FLOOD KELURAHAN BUKIT DURI AND KEBON BARU







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Survey Report

Risk and Hazard Assessment for Jakarta Flood

Bukit Duri and Kebon Baru

1 Background

Flood is a regular event in Jakarta. Records show that Jakarta had been stroked with several major floods. The most recent flood was in February of 2008. However, the flood of 2007 was the most devastating flood that paralyzed the city for several days. More than 60% of the city was under water.

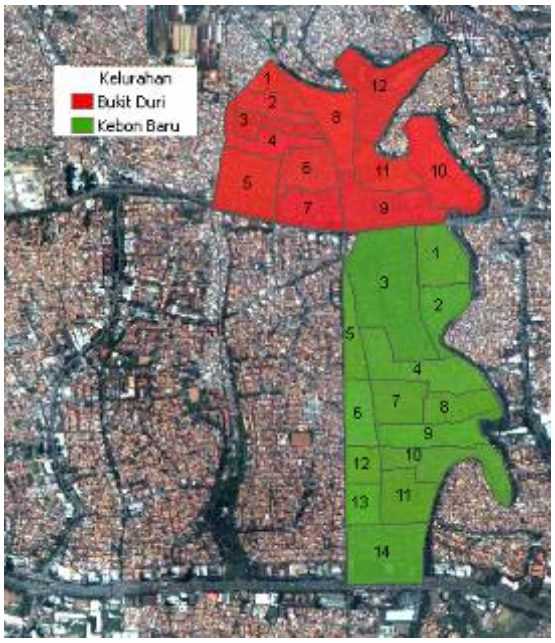


Figure 1. Location

Bukit Duri and Kebon Baru region is located in the South Jakarta, upstream of the Manggarai Gate. Bukit Duri consists of 12 RW and Kebon Baru consists of 14 RW as shown in the figure above bellow. The area was heavily damaged in the flood of 2007. Risk and hazard assessment is conducted in the area.

2 Method

Survey was conducted to obtain field data which will be used to develop and to calibrate the risk and hazard assessment. The scope of works is as follows:

1. Field observation regarding the environment and physical condition.
2. The physical condition of the area is observed to have a better description on environmental physical condition. Litter, garbage, living condition, public infrastructures, etc are observed during the survey.

3. Field observation regarding the drainage system and hydraulic structures condition.
4. The drainage system and hydraulic structures availability, capacity, condition for channels, pumps, levees, is observed.
5. Interview with the locals to obtain information regarding flood event.
6. Information regarding the flood parameters such as depth, duration, damages and other details is obtained by interviewing the locals.
7. Collecting secondary data from government office.

Secondary data such as, population and demographic is collected from government office at each location.

3 Environmental Condition and Physical Condition

The Bukit Duri area environmental condition is more degraded than the Kebon Baru area. The river bank is highly polluted due to illegal housing. More over, the locals have lower awareness in environment. There are several schools, home industries, local health facilities (Posyandu) scattered around the area. It should be noted that SMU 8, which is a prestige high school, is located within the vicinity. Bukit Duri area has minimum flood awareness. There is no Flood Post. The government office or RW post is usually serve as the Flood Post during the flood.

Figure 2. Bukit Duri River Bank

Figure 3. Kebon Baru River Bank

The Kebon Baru river bank is quite clean due to the levees development in the area. There are not many illegal housing in the bank. The people is aware more aware to environment. However, at some places, especially in the other side of the bank, illegal housing and litter is still a problem. The area is economically more developed than the Bukit Duri area. Stores,

offices, beauty saloon, restaurant, schools, mosques, are scattered around the Kebon Baru area. The local health facilites (Posyandu) are available at each RW. Several RW are facilitated with Flood Post. Within the post, information regarding the flood is provided.

Figure 4. Flood Post in Kebon Baru

4 Drainage System and Hydraulic Structures

Figure 5. Bukit Duri Main Channel

The Bukit Duri area has no levees along the river. The drainage system is not well planned and developed. The housing clusters are chaotic due to numerous illegal housing. The channel is in a very bad condition due to litter, and illegal housing.
On the other hand, The Kebon Baru area has a good drainage system. Levees and bank protections are continuously developed. Most RW are equipped with flood gates and pumps. However, pumps are not available at RW 4 and 8. It can be concluded that the Kebon Baru drainage system is basically polder system. The area with low land elevation where the water can not flow gravitationally to the river is protected from the river flood with levees, and the water within the area is pumped to the river. The channel is rehabilitated by dredging.

Figure 6. River Protection and Rehabilitation in Kebon Baru Area

Figure 7. Pumps and Gates in Kebon Baru Area

5 Flood Event

The worst flood occurs 2007. The flood has devastated both areas. The Bukit Duri district was flooded up to 6 meters high at several locations. The SMU 8 was flooded up to the second story of the building. During the flood, there was one casualty at RW 10. Several houses at the bank were swiped away by the flood. Based on the interview, the locals were already warned for the flood, however many of them choose to stay and guard their belongings. Others moved to the government office. Helps was coming from organization, government, personal, etc. They were distributed to the locals. However, helps and evacuation team can not reach the river bank area due to the strong current. Locals said that the flood lasted for about a month.

Figure 8. Interview with The Locals

The levees in Kebon Baru area were over topped. The area was flooded up to 4 meters high. The locals were moving to offices parking spaces and government office. Helps was coming from organization, government, personal, etc. They were distributed to the locals. However, helps and evacuation team can not reach the river bank at RW 1, 2 and 10 due to the strong current. The flood lasted for about a month. It should be noted here that due to the unavailability of pumps in RW 4 and 8, both RW was having troubled to drain their area. After the flood, it is said that there were about 1 meter high of mud in the area.

6 Secondary Data

The government offices at both locations had supplied data regarding the demographic and other condition of the areas. The following is data regarding the population.

Table 1. Population and Demographic

RW	Population by Gender		Population by Age		Total
	L	P	<14	>50	
	Kebon Baru				
1	1412	1263	698	457	2675
2	1347	1100	639	418	2447
3	1249	1045	599	392	2294
4	1545	1124	697	456	2669
5	1047	1416	643	421	2463
6	1945	1387	870	569	3332
7	1416	1236	692	453	2652
8	1405	1247	692	453	2652
9	1318	1221	663	434	2539
10	1575	1118	703	460	2693
11	1315	1261	672	440	2576
12	1437	1132	671	439	2569
13	1362	1260	684	448	2622
14	1480	833	604	395	2313
	Bukit Duri				
1	1666	1715	882	577	3381
2	1207	1310	657	430	2517
3	1061	683	455	298	1744
4	1118	1189	602	394	2307
5	3085	2357	1420	929	5442
6	2354	2309	1217	796	4663
7	1666	1283	770	504	2949
8	1653	1457	812	531	3110
9	1376	1368	852	303	2744
10	1762	2299	1261	448	4061
11	1803	1978	1174	418	3781
12	2457	2544	1552	552	5001

Analysis Report

Risk and Hazard Assessment for Jakarta Flood

Bukit Duri and Kebon Baru

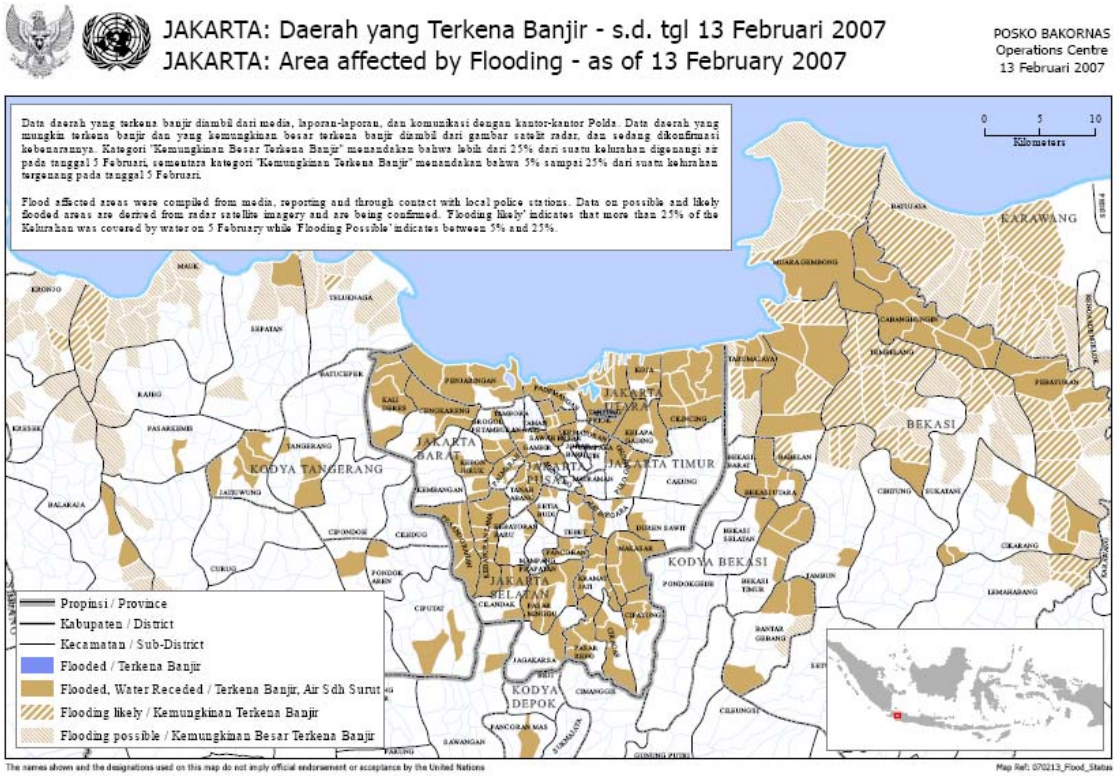
1 Background

Since there were extensive works on Flood Hazard Mapping (FHM) done for Jakarta, the objective of Activity 1.2 are to identify existing city-level FHM conducted by various national/international institutions, followed by to conduct rapid vulnerability assessment for sub-district-level and/or municipality-level of selected project site. These works of flood hazard mapping and vulnerability assessment will be conducted by one ITB expert and teams. Result of activity 1.2 is a flood hazard profile of DKI Jakarta and risk profile for designated sub-district (kecamatan) and/or its respective municipality.

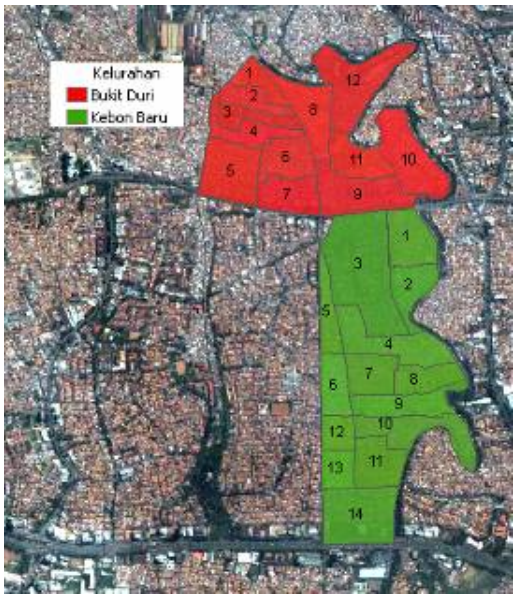
Both of flood hazard and risk profiles are necessary to base the development of city-level DRMP – Disaster Risk Management Plan under Activity 4.1, as an advocacy for mainstreaming risk management framework in City Governance. The risk profiles of sub-district and/or municipality level are necessary to base the activities of Component 2.

Based on some information collected in the Activity 1.2, the case study area will be selected for the implementation of disaster risk reduction intervention under activities of Component 2, i.e. Activity 2.2, 2.4, 2.5 and 2.6. A Technical Working Group (TWG) will be formed to conduct the selection of the case study area. The group will be around 10 persons, consisting of ITB experts, JPG Officials and related stakeholders.

2 Global Hazard Map

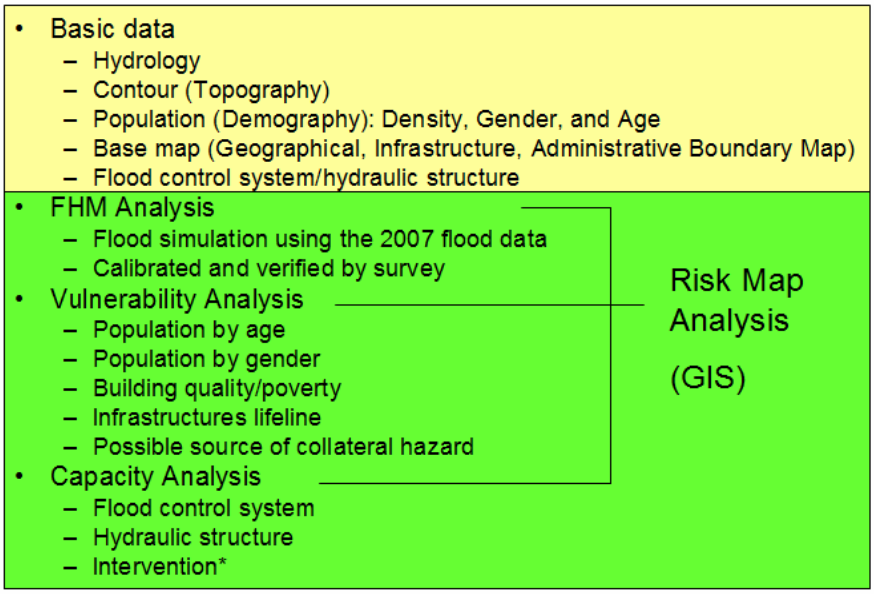


The flood of 2007 has devastated Jakarta with more than 60% of its area were flooded. Flood hazard map from the flood was obtained from BAKORNAS as shown on the figure above. Kelurahan Bukit Duri and Kelurahan Kebon Baru, Sub District Tebet, Jakarta were selected as the case study for this project.



Bukit Duri consists of 12 RW and Kebon Baru consists of 14 RW.

3 Analysis



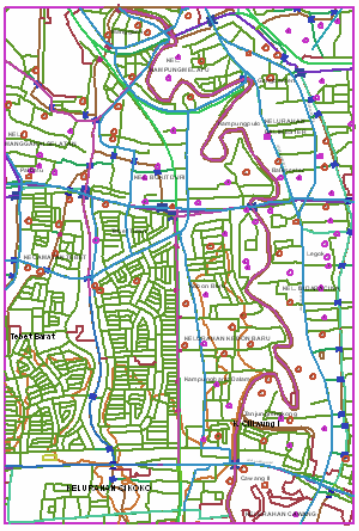
Analyses phases are as follows:

1. Basic data collecting
2. FHM analysis
3. Vulnerability analysis
4. Capacity analysis
5. Risk map analysis

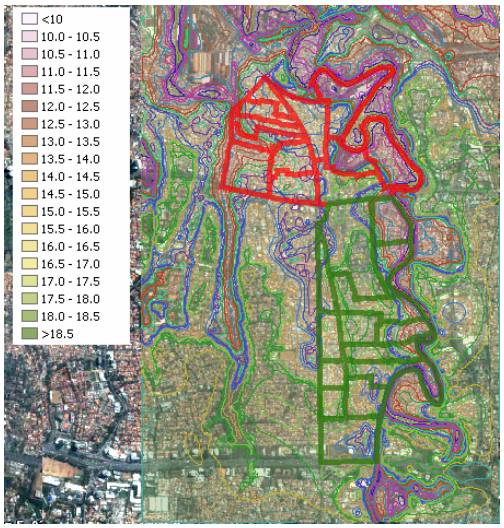
More details is given in the following paragraphs.

3.1 Basic Data

Data was collected both by site visit/survey and secondary data. Interviews with locals are conducted during survey (reff. Survey report). Other data were collected from institution.

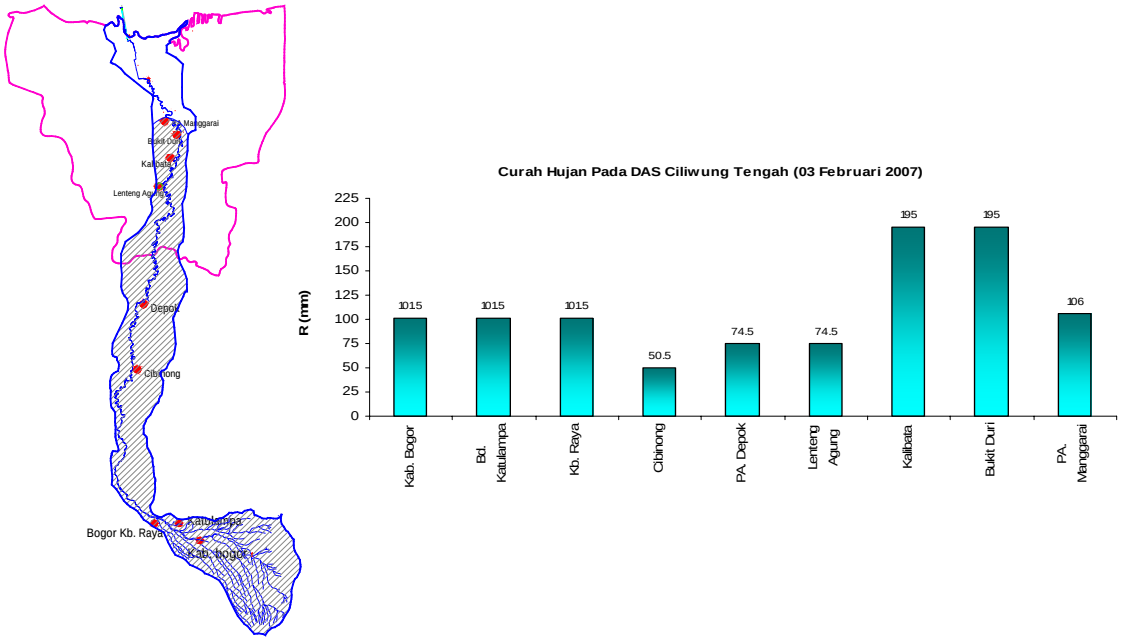


Base Map



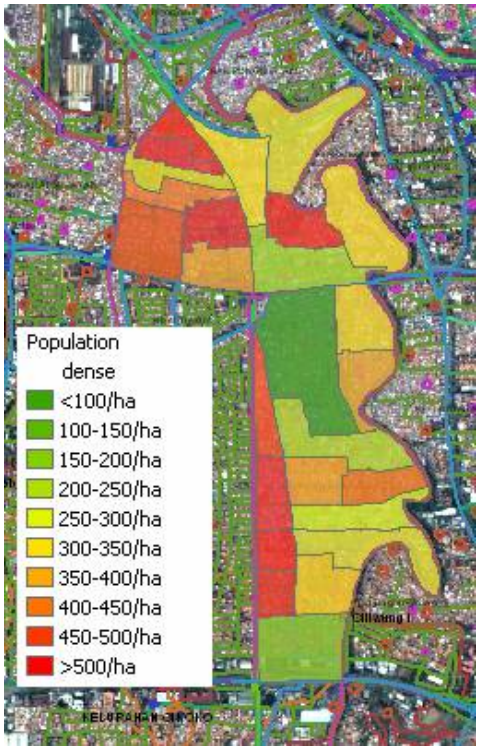
Topography

The base map and topography map with scale of 1:1000 are used in the study. The data were obtained from the DPPT. Generally the Bukit Duri area is lower than the Kebon Baru area.



Rainfall Data

Rainfall data during the 2007 flood are collected from various stations, scattered within the middle Ciliwung River Basin.



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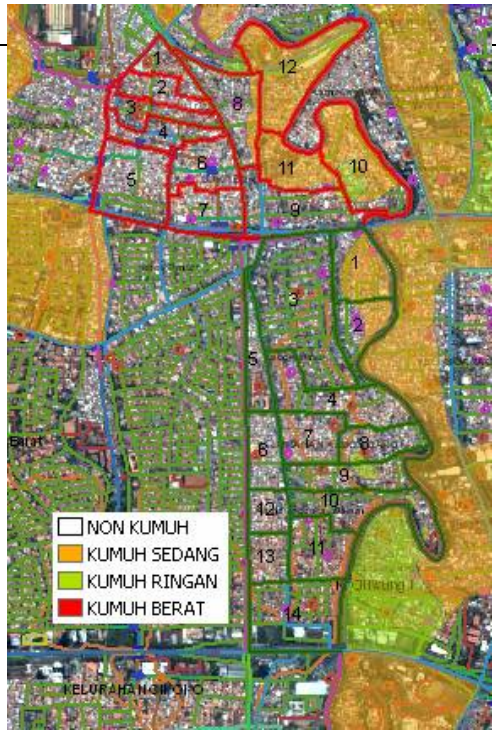
Population and Demographic

Population and demographic data (density, population by age, population by gender) were collected from Local Government Institution.

The building type/poverty information was obtained from DPPT. The definitions of the classes in the building type/poverty map on the right are as follows:

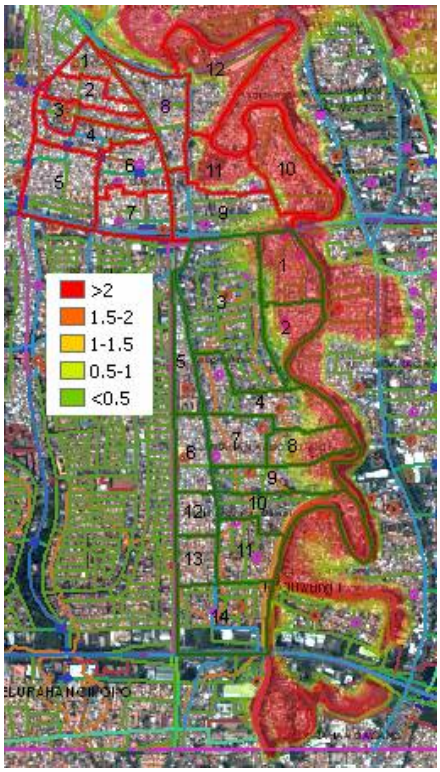
1. **Non kumuh**: Good quality building, mid-high economic class
2. **Kumuh ringan**: Medium quality building, mid-high economic class
3. **Kumuh sedang**: Low-mid quality building, low-mid economic class
4. **Kumuh berat**: Low quality building, low economic class



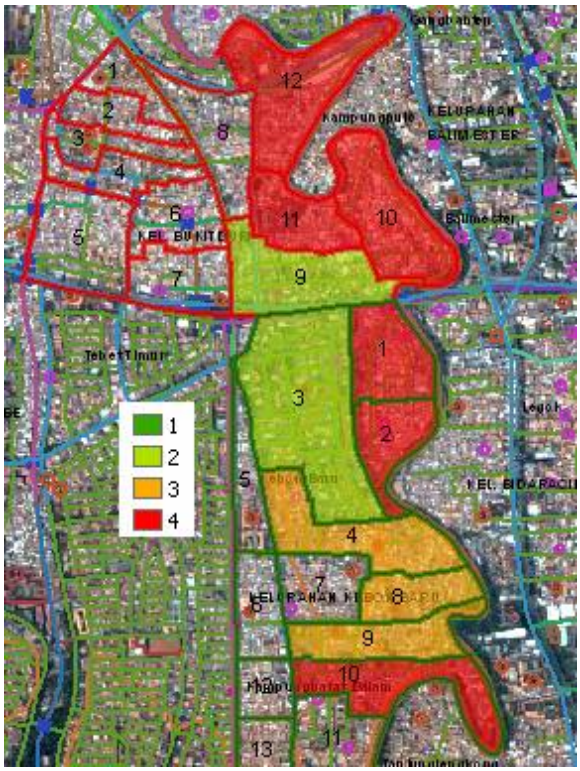
Building Type/Poverty Map

3.2 Flood Hazard Map

Flood hazard map is developed using mathematical model. DUFLOW software, developed by DELFT, is chosen for the purpose. The design flood for the map is the 2007 flood. The hydrology data of the 2007 flood was used as the model input along with the topography map and drainage system and capacity within the area. The simulation result is calibrated and verified with field data. The following image is flood hazard map, from the simulation for the 2007 flood.



Flood Hazard Map



Flood Hazard Index

The river bank areas are flooded up to more than 2 meters depth. 4 RW in Bukit Duri (9,10,11,12) and 7 RW in Kebon Baru (1,2,3,4,8,9,10) were flooded. The flood hazard map is indexed per RW using the following criteria:

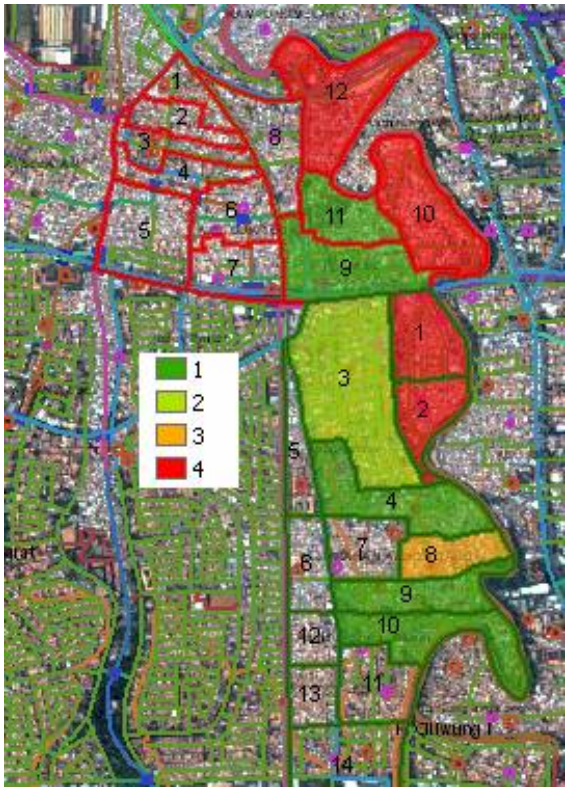
- Index 4: more than 80% area are flooded more than 2 meters deep
- Index 3: 40%-80% of area are flooded
- Index 2: 10%-40% of area are flooded
- Index 1: less than 10% of area are flooded

3.3 Vulnerability Analysis

Several parameters are used in the analysis. Each one is given weight of importance defining the significant of the parameter to the vulnerability. The following parameters is assessed for the vulnerability analyses,

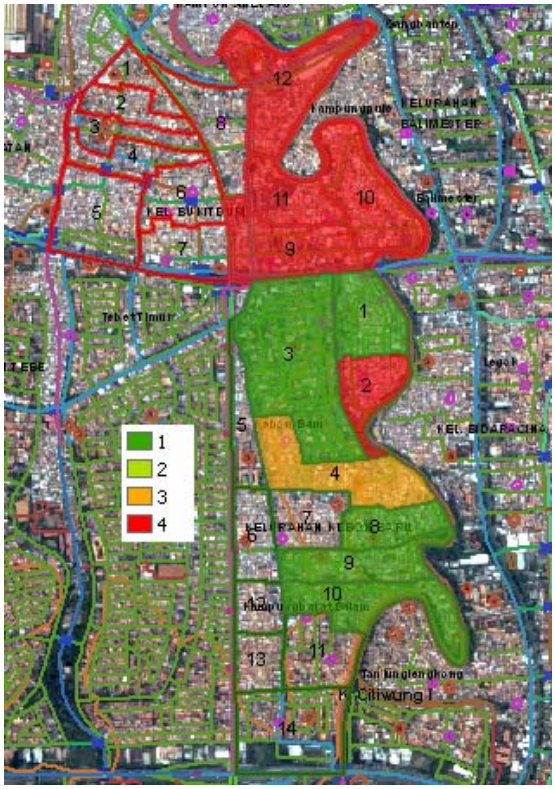
1. Infrastructures life line (25%)
2. Building type/poverty (30%)
3. Population by gender (15%)
4. Population by age (15%)
5. Possible source of collateral hazard (15%)

The parameters are clustered per RW which is flooded. Each parameter is indexed, the higher the index value, the more vulnerable.



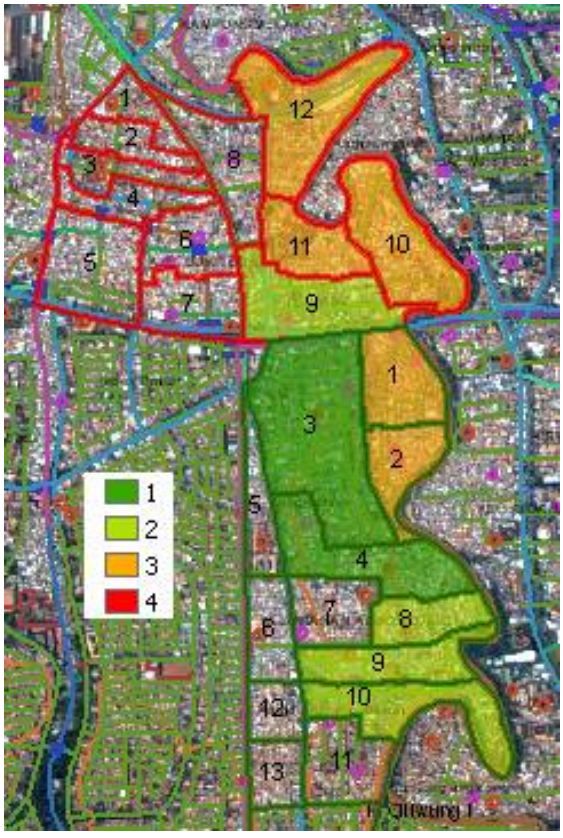
- Index 4: more than 90% infrastructures are flooded more than 2 meters deep
- Index 3: 50%-90% of infrastructures are flooded than 2 meters deep
- Index 2: 20%-50% of infrastructures are flooded than 2 meters deep
- Index 1: less than 20% of infrastructures are flooded than 2 meters deep

Infrastructures Life lines Index



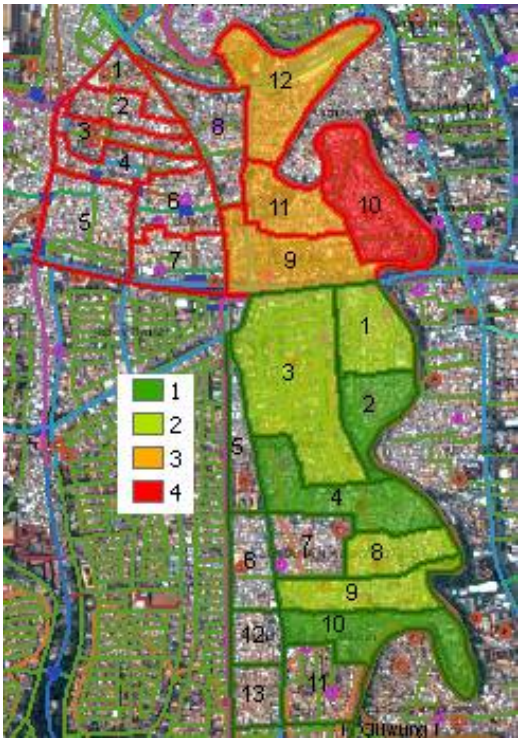
- Index 4:
  Potential cause to death, disease, and environmental damage
- Index 3:
  Potential cause to disease, and environmental damage
- Index 2:
  Potential cause to environmental damage
- Index 1:
  No possible source of collateral hazard

Possible Source Collateral Hazard Index



- Index 4
  Majority of houses are non permanent, without proper access road (capacity only for pedestrian)
- Index 3
  Majority of houses are non permanent, without proper access road (capacity can accommodate motorcycle)
- Index 2
  Majority of houses are permanent, with less proper access road (capacity can accommodate single car)
- Index 1
  Majority of houses are permanent with proper access road

Building Type/Poverty Index



- Index 4
  less than 45% of the population are male
- Index 2
  45%-50% of the population are male
- Index 3
  50%-55% of the population are male
- Index 1
  more than 55% of the population are male

Gender Index

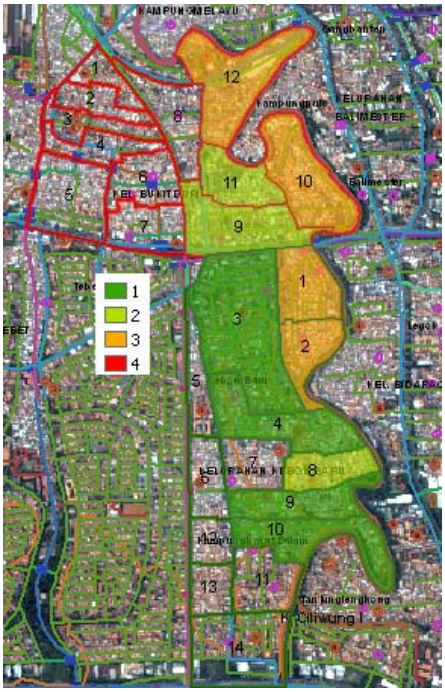
- Index 4
  more than 55% of the population are at the age <14, >55
- Index 3
  50%-55% of the population are at the age <14, >55
- Index 2
  45%-50% of the population are at the age <14, >55
- Index 1
  less than 45% of the population are at the age <14, >55

Age Index

The parameter index maps are overlaid and superimposed with the following formula:

Vulnerability index = Infrastructures life line (25%) + Building type/poverty (30%) + Population by gender (15%) + Population by age (15%) +Possible source of collateral hazard (15%)

The result is as follows:



- Index 4
  Extremely vulnerable
- Index 3
  Highly vulnerable
- Index 2
  Moderately vulnerable
- Index 1
  Low vulnerable

Vulnerability Index

3.4 Capacity Index

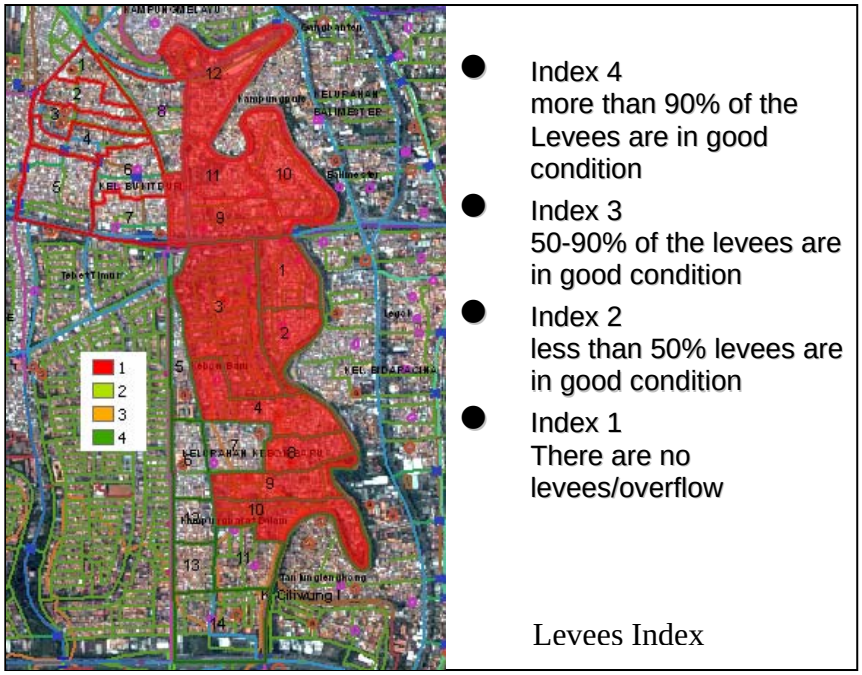
- Index 4
  more than 90% o
  Levees are in go
  condition
- Index 3
  50-90% of the le
  in good condition
- Index 2
  less than 50% le
  in good condition
- Index 1
  There are no
  levees/overflow

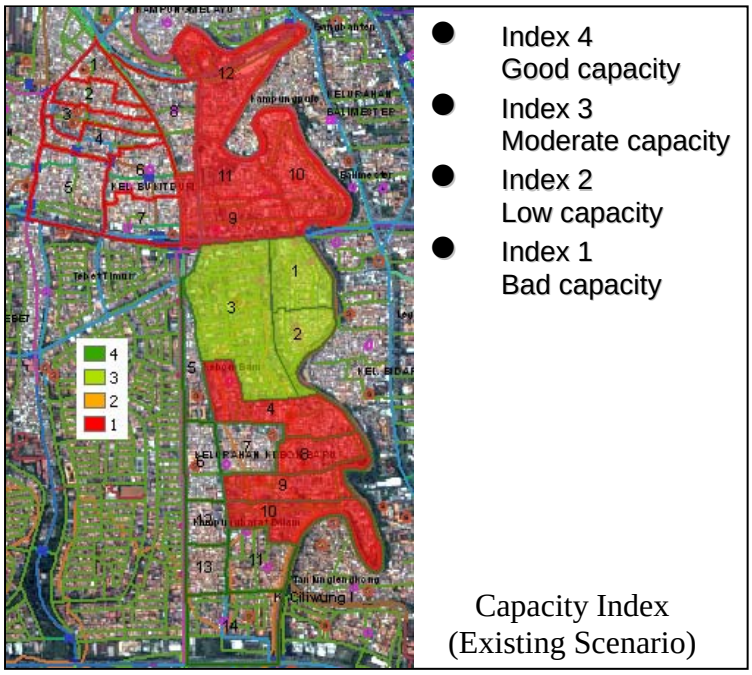
Pump Index

Several parameters are used in the analysis on capacity; each one is given a weight based on importance. The following parameters is assessed for the capacity analyses,

1. Pumps (existing condition) (50%)
2. Levees (existing condition) (50%)
3. Intervention (intervention condition)

The parameters are clustered per RW which is flooded. Each parameter is indexed, the higher the index value, the higher the capacity.





The capacity index is calculated as follows:

0.5 x levees index + 0.5 x pumps index

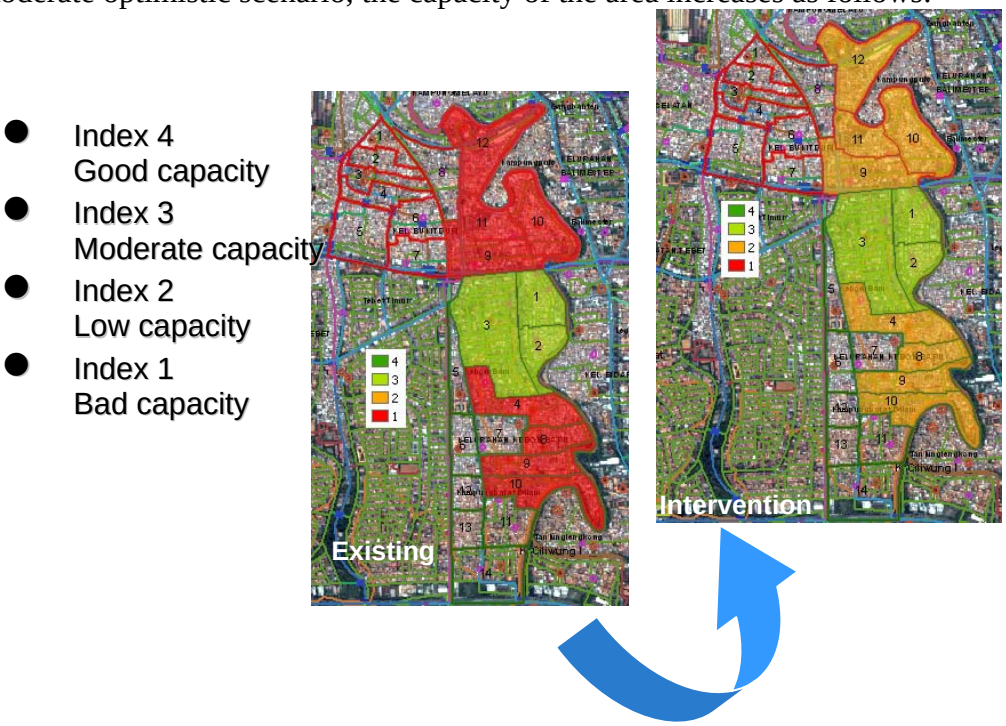
The PROMISE program (intervention) is expected to increase the capacity of the area. The people are given training to increase their awareness on flood disaster mitigation. The people are given training to increase their readiness and preparedness on flood disaster and also establishing an early warning system at community level. A better preparation would lead to a higher chance of survival (reducing risk).

In the intervention scenario, there are two assumptions.

- Moderate-Optimistic:
  - Climate will not change significantly
  - Program is successfully implemented and developed
  - No significant environmental damage in the upstream river basin

- Moderate-Pessimistic:
  - Climate will change significantly
  - Program implementation and development faces problems such as irregular system maintenance, etc
  - Significant environmental damage in the upstream river basin

In the moderate optimistic scenario, the capacity of the area increases as follows:



Capacity Index (with intervention moderate optimistic scenario)

Capacity Index (with moderate pessimistic scenario)

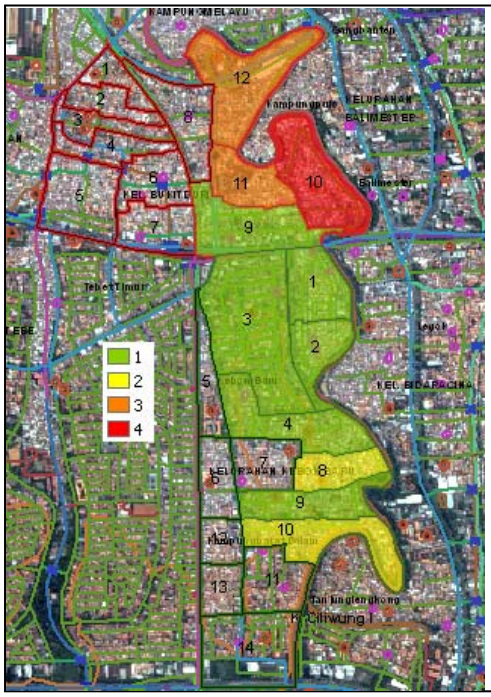
The moderate-pessimistic scenario improves capacity within the area. However, the moderate pessimistic scenario does not gives significant effects to the capacity index

3.5 Risk Map

The risk map is assessed using GIS. The hazard map index, vulnerability index and capacity index are overlaid and superimposed using the following formula:

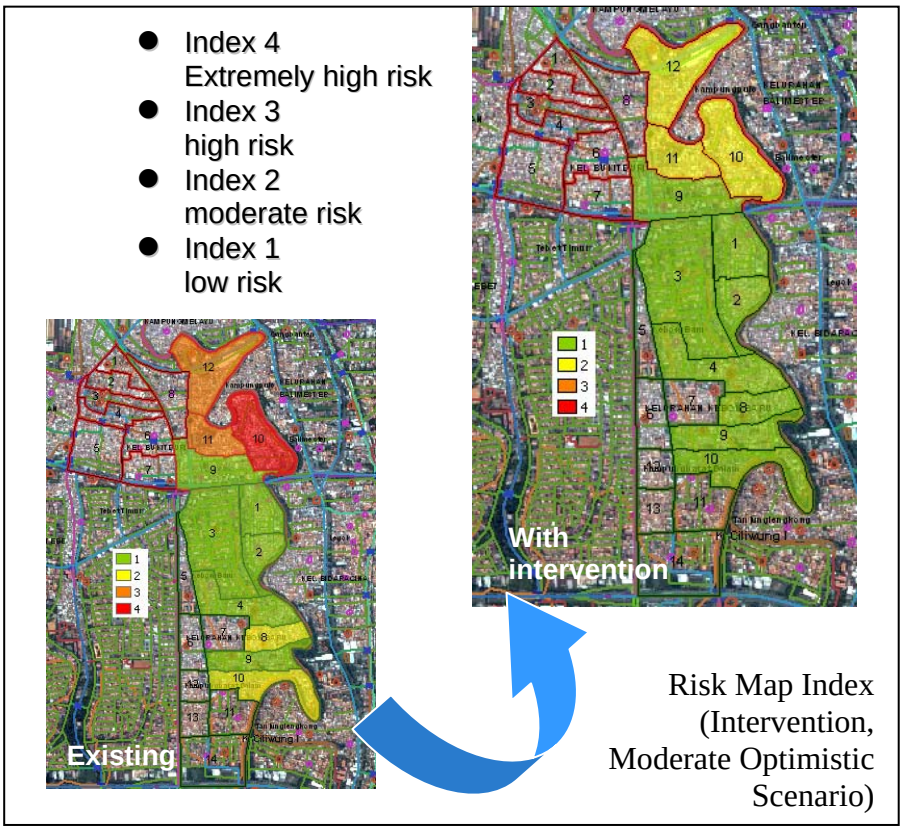
Risk = Hazard index x Vulnerability index / Capacity index

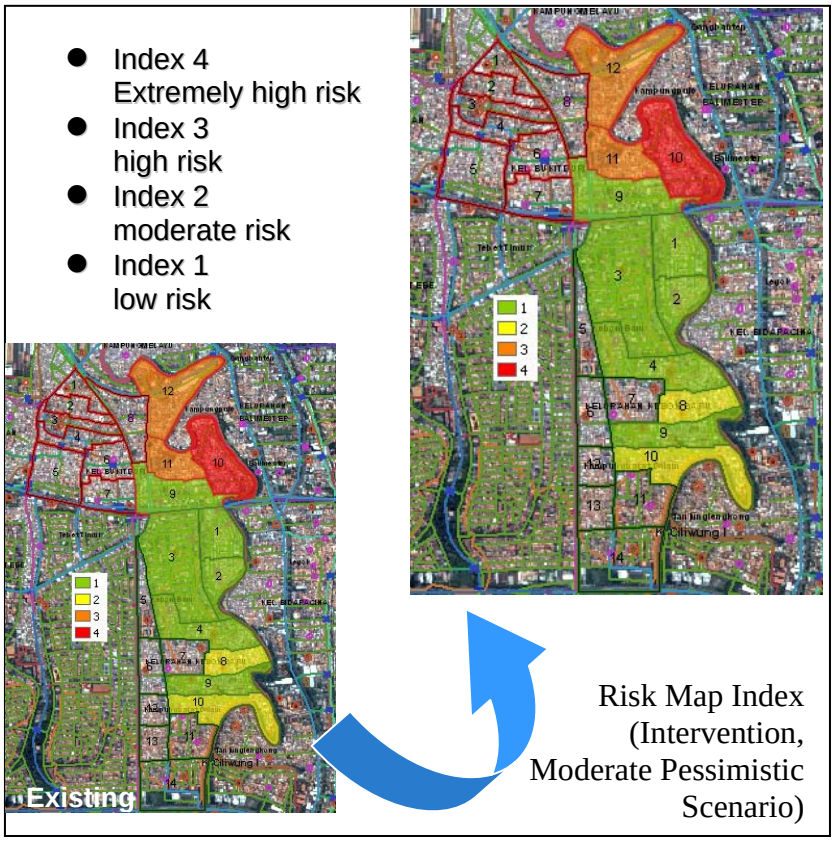
The results are as follows:



- Index 4
  Extremely high risk
- Index 3
  high risk
- Index 2
  moderate risk
- Index 1
  low risk

As has been stated previously that the capacity index are assessed using two scenario, existing and intervention scenario. Therefore the risk map is also assessed using the same scenarios.





The intervention (moderate optimistic scenario) shows that the risk is significantly decreasing in several areas. However, the risk index for intervention (moderate pessimistic scenario) does not show significant improvement compare to the existing condition.

4 Conclusion

Generally, Kelurahan Bukit Duri has a higher risk than Kelurahan Kebon Baru due to several causes, which are:

1. Higher Vulnerability due to low environmental condition
2. Lower Capacity due to inadequate drainage system and hydraulic structures (no pumps and levees)

Based on the simulation results, intervention (moderate optimistic scenario) would reduce the risk significantly in some areas.