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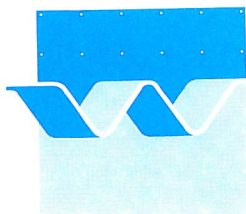
Exercises Operational Flood Management

report

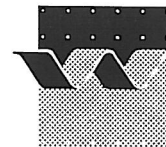
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Exercises Operational Flood Management

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wl | delft hydraulics



CLIENT: Ministry of Transport, Public Works and Water management
 Directorate-General of Public Works and Water Management
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TITLE: Exercises operational flood management

ABSTRACT:

This report describes some exercises with respect to operational flood plain management for use in a training course in Poland. One exercise deals with risk perception, another deals with monitoring and emergency measures during river floods.

REFERENCES:

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I Introduction

In July 1997, parts of Poland were inundated during a high river flood in the Odra due to heavy rainfall. Within the framework of the Memorandum of Understanding (MOU) on Water Management, the Dutch Government offered Poland assistance related to the Odra flooding.

As decided in a meeting between Polish and Dutch experts on the 12th of September 1997, on the short term three items were considered as the most important to be carried out in the framework of the Memorandum of Understanding [1] :

- forecasting and warning;
- flood protection infrastructure;
- flood protection strategy.

As part of the last two items, during this meeting a proposal was accepted to organise a workshop on operational flood management.

This workshop will take place from the 21st till the 23rd of January 1998. Attention will be given to the following subjects:

- Organisation and legislation;
- Risk and risk perception;
- Monitoring during a flood;
- Emergency measures;
- Crises management;
- Maintenance and construction;
- Project management during reinforcement of dikes.

Furthermore, some exercises will be carried out by the participants of the workshop to apply the above mentioned subjects in real cases and to get the opportunity to talk with other organisations, which is one of the goals of the MATRA project.

The Ministry of Transport, Public Works and Water Management has asked WL|Delft Hydraulics to carry out the preparation of the exercises. By fax of 11 December 1997 (reference RBM10609/R3236/FdH) WL|Delft Hydraulics submitted a proposal for the preparation of the exercises. By fax of 12 December 1997 the Ministry of Transport, Public Works and Water Management has approved the proposal and commissioned the preparation.

This report describes the exercises. Chapter 2 outlines the approach used to define the exercises. Chapter 3 describes the introduction to the exercises, an exercise dealing with risk perception and an exercise dealing with monitoring and emergency measures. Chapter 4 contains instructions for the facilitators of the exercises.

2 Approach used to set up the exercises

A stepwise approach was used to develop of the exercises presented in this report. The sections below describes how the exercises were developed.

Objective of the exercises

The purpose of the exercises is to create an opportunity for discussion for the participants. It is not necessary that the answers to the questions are correct or complete. The exercise about risk perception is aimed at creating a feeling of the processes that play a role when decisions have to be taken under an increasing pressure. The exercise about monitoring and emergency measures aims to illustrate how the function of the dikes can be threatened by rising water levels, and to what types of signs the dike inspection teams have to pay attention, and how and when measures can be taken to prevent damage.

Selection of a study area

The area in which the exercises develop should be comparable to the area from which the participants of the workshop originate. However, the area should not be an exact replica of an existing region, since then the participants may start discussing what happened in that region in reality. This would make an open discussion hard to realise.

Inventory of elements

Purpose is to determine what elements should be incorporated into the exercise. In the risk perception exercise it was determined which basic threats are realistic and what the consequences of these threats, if they become reality, may be. For the monitoring and emergency measures exercise the signs and stages of deterioration of dikes and possible measures were determined.

Inventory of actors

Purpose is to determine which (groups) of people play a role in the decision process and the implementation of measures. A local, regional and national level may be distinguished. Per level several types of actors may be present.

Scenarios

A scenario consists of a succession of threats and their consequences. When a scenario is defined events are coupled to a time of occurrence. The events are autonomous and can not be influenced by the actors.

Behaviour of the actors

The actors react to the events. Per event the behaviour of one or more actors is defined. The participants in the workshop have to define the reaction of the other actors, such as the disaster management team or the mayor.

Questions

While the scenario develops, the participants have to answer questions. There are two types of questions: open questions and priority questions.

3 Introduction to the exercises

In this workshop we will use an imaginary city along the river Odra to illustrate the material presented in the lectures. This imaginary city is called Stad. Figure 3-1 shows Stad and its surroundings. During the exercises everybody plays a role as an actor in an imaginary flood scenario. This means that you have to make decisions when something happens, and that you sometimes have to convince the other actors that your decision is right.

3.1 Area description

The city

The river Odra divides the city into two parts: the old centre of the city is located on the West bank of the Odra, on the East bank a newer part of the city was built. The number of inhabitants is about 100,000. Two hospitals are situated in the city, one in the West and one in the East part. Stad is crossed by a highway. For this reason two bridges are present: one across the canal and one across the river. This bridge over the river is also the connection between the two parts of the city for slow traffic. The offices of the mayor are situated in the old part of the city at the western end of the bridge.

Hydraulic system and bathymetry

The eastern part of the city lays below the river water level, so it is exposed to flooding. Only a part of the old city is in danger of flooding since the bank slopes upwards away from the river (see Figure 3-2).

During heavy rainfall in the lower part of the catchment of the river, the water levels in the river rise rapidly. Flood waves caused by heavy rain reach Stad in about a day. The warning time for floods is very short. When high discharges occur, a part of the flow through the river is re-routed through a canal. This canal joins the river downstream of the city.

One hundred kilometres upstream of the city, at the border with the Czech Republic, a retention reservoir was built recently to store a large volume of water in case of a flood wave after heavy rainfall. Sluices regulate the filling process and also the process to empty the reservoir. Also, a local retention reservoir is available directly upstream of the city. This reservoir is a polder surrounded by sand dikes that can be inundated. It is not as large as the regional reservoir, and a water treatment plant is located in this reservoir area.

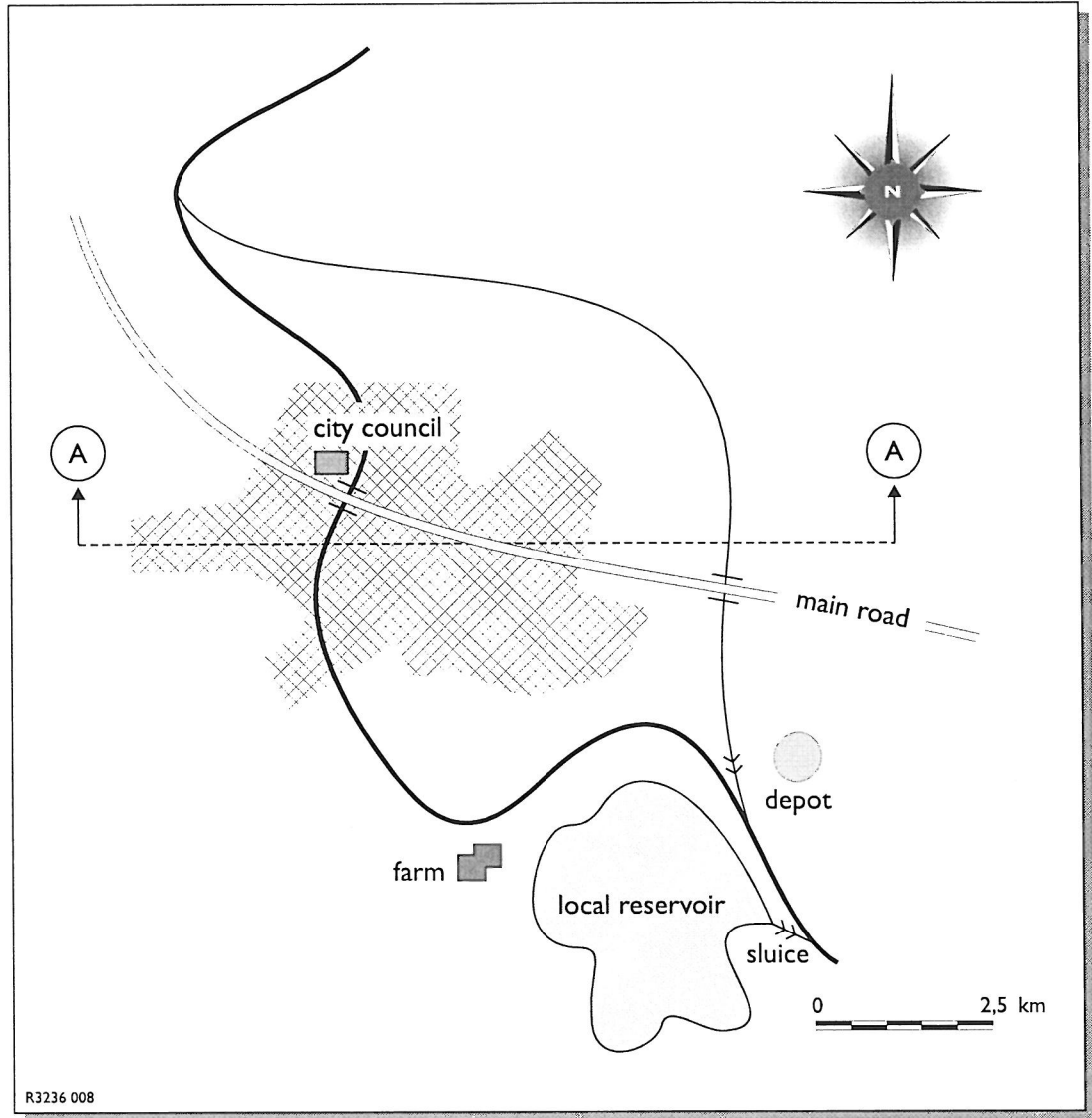


Figure 3-1 Stad and its surroundings

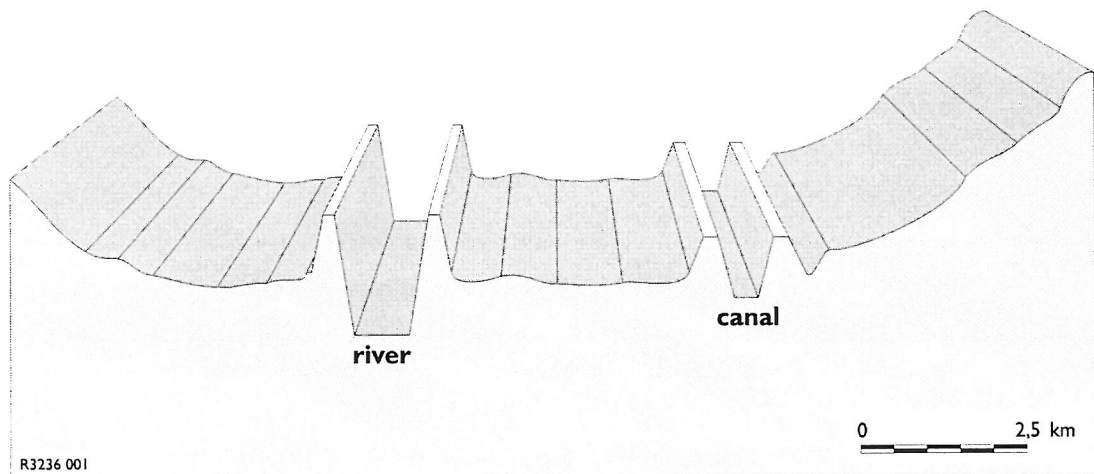


Figure 3-2 Cross section of the area of Stad

3.2 The actors

The following describes the tasks or habitats of the different actors.

The disaster management team

This team consists of delegates of various organisations such as the Voivodships, the water boards within the region, the greater cities in the region, rescue forces, etcetera. The task of the disaster management team is to co-ordinate the various actions to oppose the flood. The team meets in the offices of the mayor of the city Stad.

The head of the local water board

A local water board is responsible for the water defence systems in a certain region. In this case they are responsible for the dikes in the surroundings of the city, and for the use of the local retention reservoir.

The mayor

The mayor is responsible for the safety of the citizens. During disasters they have to take decisions to ensure the safety of the citizens. The mayor has to approve the decision to use the local retention reservoir.

The rescue forces

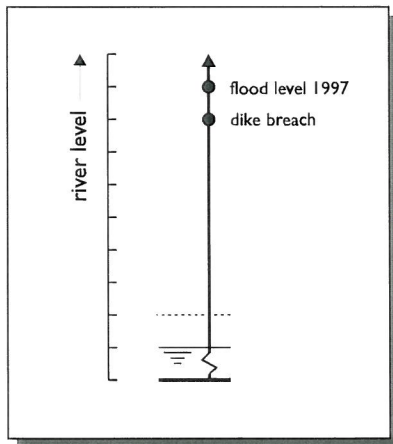
These forces can support the disaster management team and the mayor during disasters by temporary strengthening of the dikes, organising evacuation routes, etcetera.

The citizens

The citizens are the owners of property in the city and the surroundings and want to be safeguarded against the water threat.

3.3 Risk perception exercise

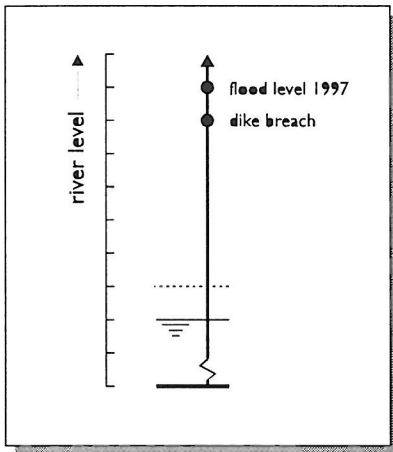
Part one (25 minutes)



Summary

After a long dry period it has started raining heavily in the upper part of the Odra catchment in the Czech Republic. This is no problem since the river flow is low at present. However, if the rain continues to fall this way for three days or more, IMGW predicts that the water level in the river will rise considerably.

¹ RWS-MD-GRAFISCHE TECHNIEKEN



Event I

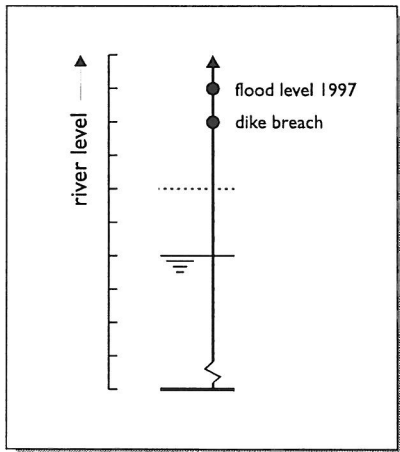
A week later: it is still raining and IMGW predicts high water levels, like in 1997, for the coming days. It is decided that the disaster management team for the middle reach of the Odra will come together to discuss if measures should be taken. In the city Stad rumours are that a flood wave is approaching.

Question I.1

What are possible reactions of the citizens to the rumours about the coming flood wave? Write down three possible reactions.

Event 2

The disaster management team decides that the regional retention reservoirs on the border between Poland and the Czech Republic will be filled. IMGW predicts that the rain will stop at the end of the day. Based on this forecast by IMGW the disaster management team expects that no problems will occur in the river if the top of the flood wave is stored now.



A day later: although the forecasts predicted that the rain would stop, it is still raining and IMGW predicts critical water levels in the river, even with the large retention reservoirs still filling up. The disaster management team decides that the cities and the rescue forces must be informed. The threat of a dangerous situation is becoming more serious: if the rain continues the situation may become critical in 24 hours. The mayor of Stad decides to inform its citizens that the situation may become critical and to advise evacuation for the inhabitants of the lowest part of the city between the river and the canal. The local water board decides to install around the clock dike inspection teams. The disaster management team instructs the rescue forces to be prepared.

Question 2.1

During the meeting of the disaster management team the fireman proposes to start placing sandbags at locations that were weak spots in 1997. The representative of the local water board thinks this is premature. What do you think? Are any other measures necessary?

Question 2.2

How can the mayor inform the citizens within half an hour that they should be prepared to leave the unsafe areas within four hours?

Question 2.3

What should the mayor advise the citizens to do to prevent as much damage as possible? Write down three things he can advise.

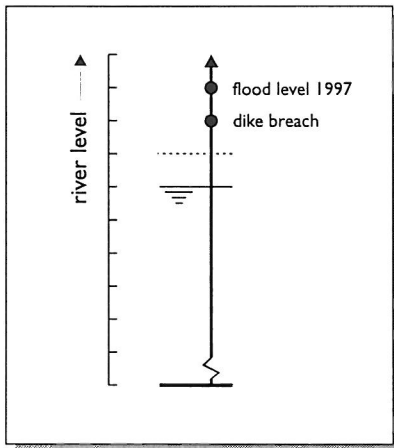
Question 2.4

How do the citizens react to the information that the water levels are rising as high as they were last year?

Question 2.5

What sort of instructions should the rescue forces get at this point? Write down the most important instruction.

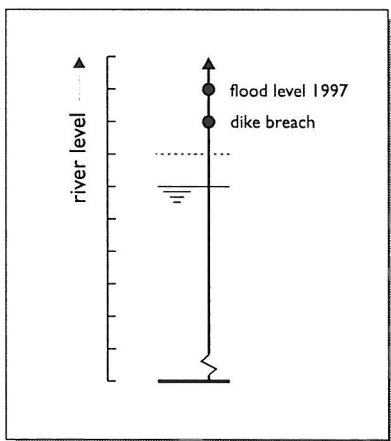
Part two (20 minutes)



demonstration in front of the city hall.

Summary

The situation becomes more serious by the hour. It is still raining in the upper part of the catchment and the water level near Stad is only one meter below the crest of the dikes. The latest forecast by IMGW predicts that the rain will continue and that the water will rise more rapidly than before the regional retention reservoirs at the border with the Czech Republic are full. When the citizens of Stad hear this news, they demand that the local retention reservoir is filled. The mayor decides that they will wait with this, since the flood wave has not yet reached its peak. Another consideration is that the water treatment plant will be inundated. The worried and angry citizens start a protest

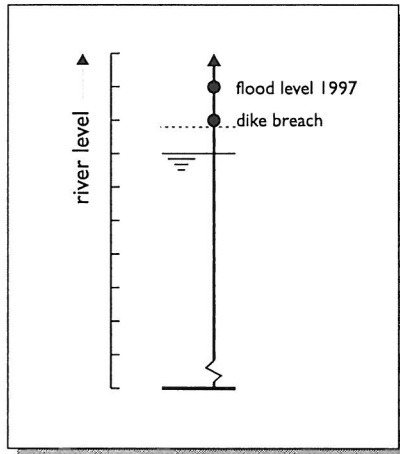


Event 3

The disaster management team decides to alert the rescue forces and the cities that real trouble is ahead and that evacuation should be considered seriously. Some citizens start fleeing when they hear this news. Companies call up their employees and try to force them to come to work and to help saving the company's possessions.

Question 3.1

Considering the latest forecast what should the mayor of Stad do?



Event 4

The mayor decides to open the sluices to the local retention reservoir so that it can start filling. He also announces that the lower part of the city will be evacuated, everybody has to leave. The people must go towards shelters in the old city centre, on higher ground to the west of the river. Companies are advised to evacuate all hazardous substances and other goods by road to the east, to the area on the other side of the canal.

Question 4.1

If you were the mayor, how would you organise an efficient evacuation within one hour?

Question 4.2

If you were a citizen, would you leave immediately if you were told so? Or would do one of the following:

1. leave immediately without taking anything with you;
2. wait till your partner comes home from work;
3. leave after bringing all your possessions to the top floor of your house;
4. collect your partner at work and leave.

Question 4.3

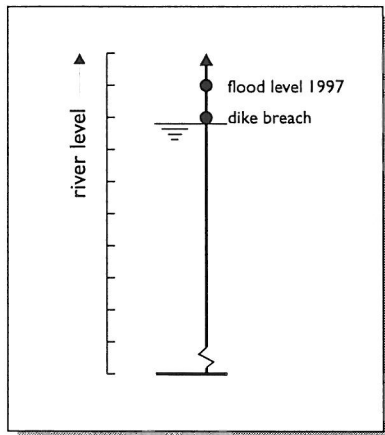
If you were a company director, how would you react to the news that you have to leave immediately?

Question 4.4

If you were the co-ordinator the rescue forces, which three actions would you give most priority to (you can not do everything):

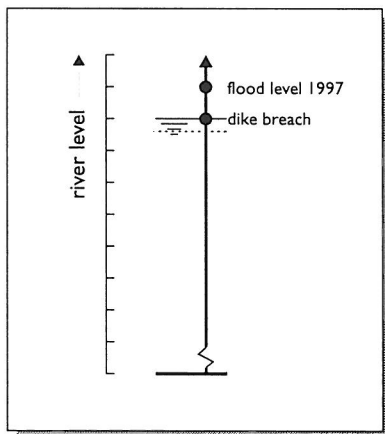
1. to place sandbags along the weak spots in the river dike;
2. to prepare an escape route for the evacuation;
3. to assist in the evacuation of hospitals;
4. to provide transport for the citizens to safe areas;
5. to guard evacuated areas;
6. to remove people that stayed behind in the unsafe areas.

Part three (10 minutes)



Summary

It is now a day after the forced evacuation. Most people (70%) have found a place in the city shelters, the rest has left town to go to relatives or friends. However, traffic has not stopped yet: trucks are still bringing company goods into safety. The road out of the lowest part of Stad is congested in both directions. The water level in the river and the canal is now 50 centimetres below the crest level of the dikes. At many locations the dikes show weak spots. The local retention reservoir is full. Fortunately the rains have stopped and the water does not rise any more.



Event 5

The western river dike breaks in the centre of the city. The lower part of the old city floods, see Figure 3-3. This part of the city was not evacuated. The ramp of the bridge is under water (50 centimetres). The city hall, located near the bridge is flooded by 1 meter of water. The main switch house of the telephone company has flooded and telephone connections are no longer available from the city hall.

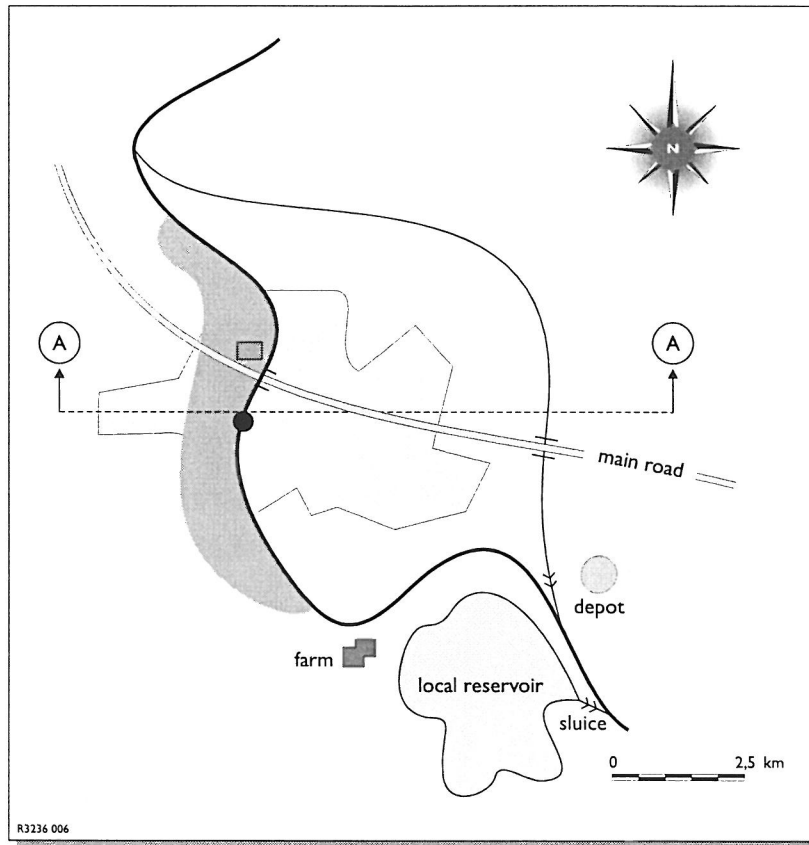
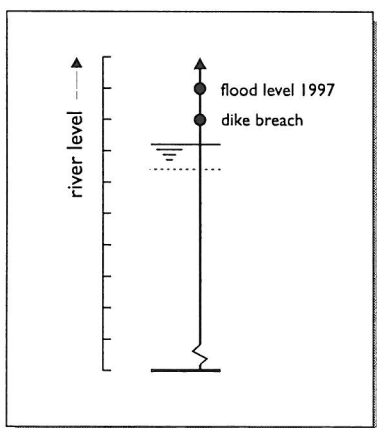


Figure 3-3 Inundation after breach of river dike

Question 5.1

You are a member of the disaster management team in the City Hall, what should the disaster management team do according to you and in which order:

1. give the evacuation of the disaster management team priority;
2. start evacuating the inundated part of the city;
3. stay where they are (without telephone connections);
4. give instructions to start closing the gap in the dike.



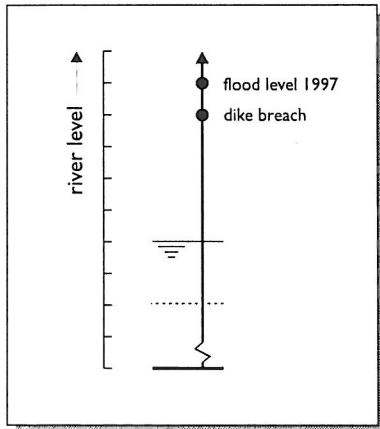
Event 6

The inundated part of the city is being evacuated. The water level in the river and the inundated part of the city are dropping. However, the wind is increasing and the local weather bureau predicts a south-westerly storm. The mayor considers stopping the evacuation of the inundated area, but the disaster management team disagrees with this proposal by the mayor.

Question 6.1

What threats does the predicted storm pose?

Part four (10 minutes)



The water level in the river has dropped further, the old city is now inundated by only 50 centimetres. The mayor has ignored the advise of the disaster management team to evacuate this part of the city. The mayor has given the highest priority to the repair of the breach in the river dike. They plan to release the stored water when the gap in the dike has been closed. The storm is now at full force at 8 Beaufort.

Event 7

The storm causes large waves in the local retention reservoir. The attack on the crest of the dike is so vigorous that the western dike breaks. So much water is released that the eastern river dike breaks and the part of the city between the river in the canal is inundated (Figure 3-4). This causes malfunctioning of the sewer system and causes trouble in the power supply.

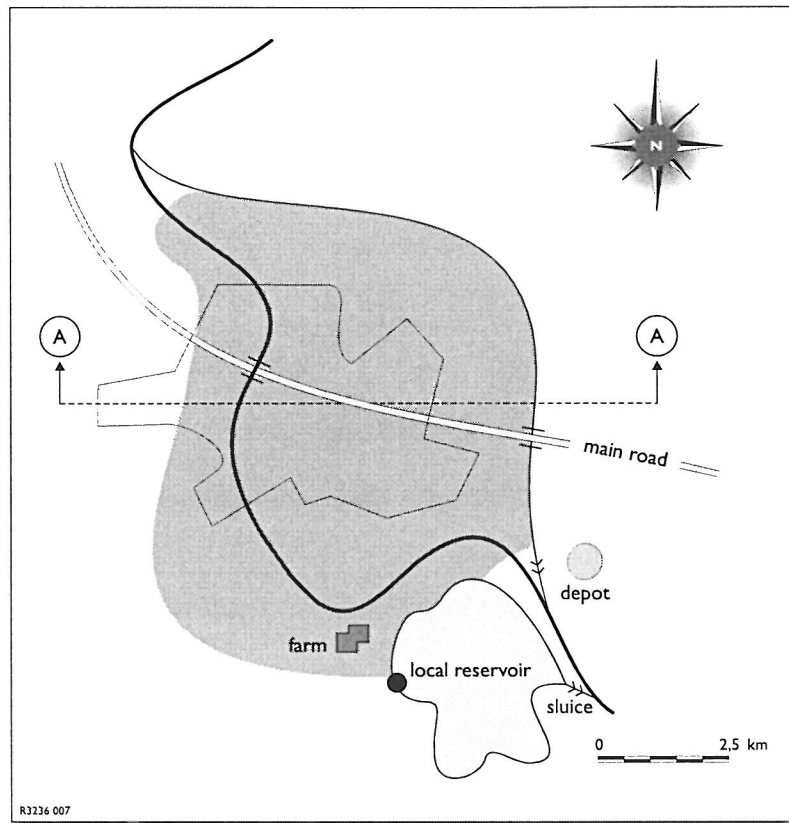


Figure 3-4 Inundation after breach of reservoir dike

Question 7.1

How could the second flooding have been prevented?

Evaluation (plenary)

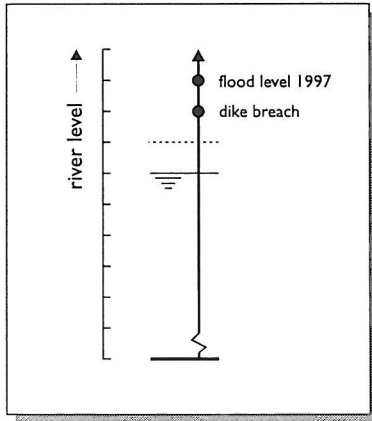
Formulate the groups conclusions with respect to this exercise:

- what did you learn?
- what actors did you miss in the exercise?
- did you enjoy doing the exercise?
- would you do this again?

3.4 Monitoring and emergency measures exercise

Part one: initial situation (15 minutes)

Summary



It has been raining steadily for more than a week in the upper catchment of the river Odra. The water levels in the river are high. The disaster management team for the middle reach of the Odra has come together and decided that the regional detention reservoirs on the border between Poland and the Czech Republic should be filled. IMGW predicts that the water levels will continue to rise, even with the large retention reservoirs still filling up. The threat of a dangerous situation is becoming more serious: if the rain continues, the situation may become critical in 24 hours. The water level in the river is one metre below the crest level of the dikes. The northerly wind has picked up to 5 Beaufort.

Event I

The local water board has installed around the clock inspection of the dikes by teams of two persons per stretch of 5 kilometres. Communication occurs with mobile phones. Since most dikes are not accessible for traffic, the teams must inspect the dike by foot.

Question I.1

What should the dike inspection teams look for at this stage?

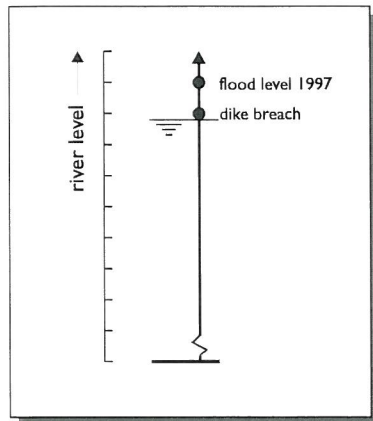
Question I.2

What measure can be taken at this stage to prevent future damage?

Question I.3

Which of these situations reported by the inspection teams would you classify as the most dangerous? Why?

Part two: contradictory reports (15 minutes)



Summary

A day later: the situation becomes more serious by the hour. It is still raining in the upper part of the catchment and the water level near Stad is only 50 centimetres below the crest of the dikes. The latest forecast by IMGW predicts that the rain will continue and that the water will rise more rapidly than before: the regional retention reservoirs at the border with the Czech Republic are full. The local retention reservoir near the city are filling up. Due to lack of staff the dike around the reservoir is inspected only once per day.



The inspection teams report (see Figure 3-5):

1. seepage along the eastern canal dike;
2. large amounts of floating debris against the western dike at the downstream confluence of the river and the canal;
3. a small lengthwise crack in the crest of the eastern river dike close to the bridge;
4. wave overtopping of the western river dike in the centre of the city; and
5. several sand boils along the foot of the eastern canal dike.

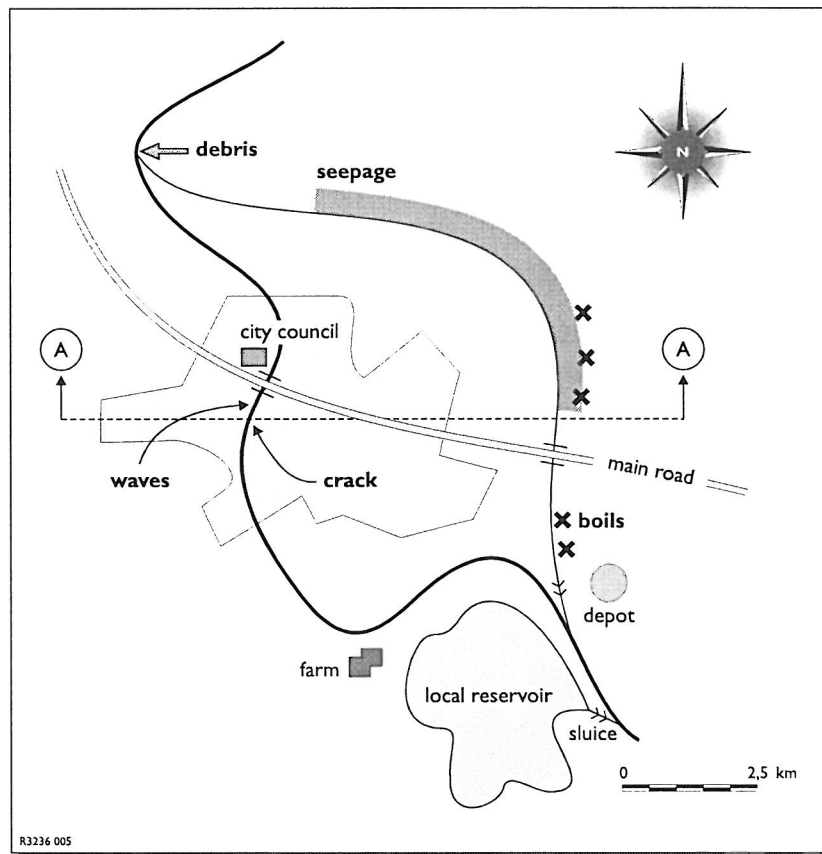


Figure 3-5 Trouble reported by dike inspection teams

Event 2

A farmer reports that water is coming through the western river dike upstream of the city (see Figure 3-6). The inspection team responsible for this section of the dike did not report any problems. A policeman crossing the bridge happens to feel the impact when a large ship, broken loose from its moorings along the dike, collides with a bridge pylon. The policeman notices that the bridge seems to move after this collision and he phones the disaster management team to tell them that this is very serious.

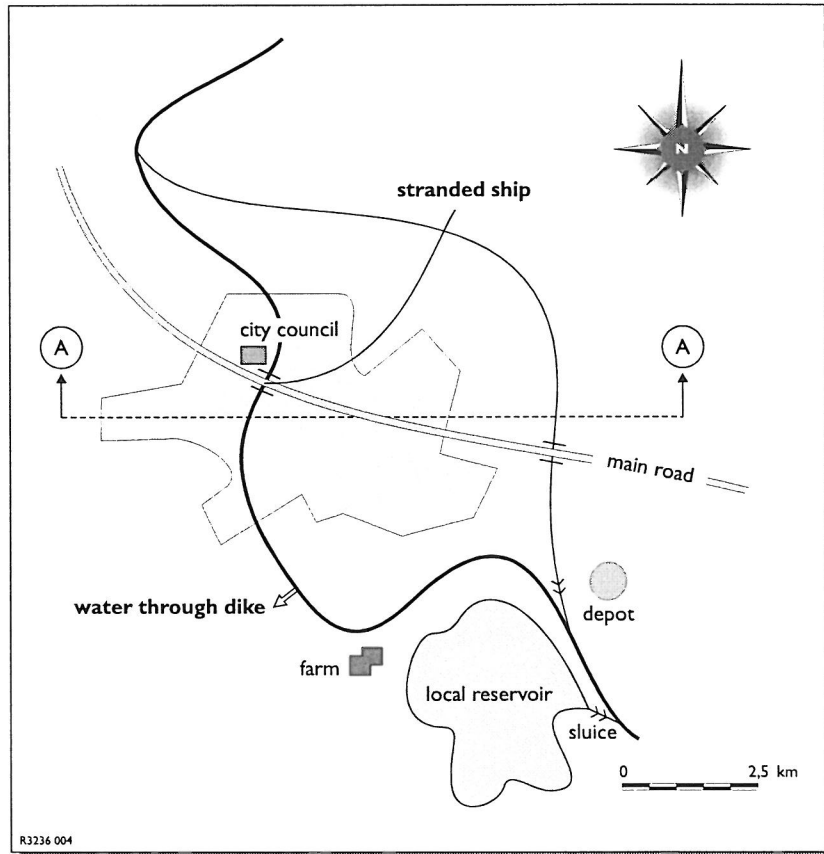


Figure 3-6 Trouble reported by individuals

Question 2.1

Which of these situations reported by the inspection teams would you classify as the most dangerous? Why?

Question 2.2

The chairman of the disaster management team says the policeman's story is not important. What do you think?

Question 2.3

What would you do with the report by the farmer?

Part three: lack of material (10 minutes)



Summary

The situation becomes worse:

- A farmer reports five very active sand boils along the north-western dike around the retention reservoir (see Figure 3-7).
- The crack in the eastern river dike is becoming larger. It has now a width of 2.5 cm and a length of 20 metres.
- The mayor has ordered that as many sandbags and sand as possible must be transported to the western part of the city of the city to heighten the western river dike and reinforce the dikes of the retention reservoir. About 50% of the required sand has been transported already.

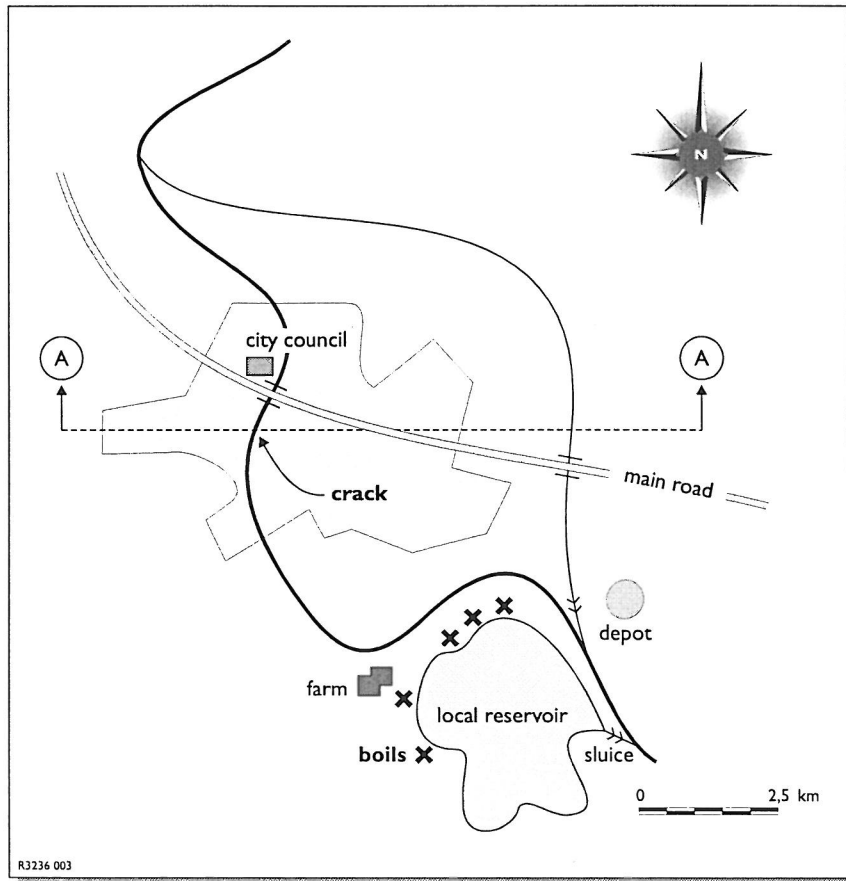


Figure 3-7 More reported trouble by individuals

Event 3

The bridge pylons are washed away by the strong current. The bridge collapses. The only route to the sand depot is through the next city, about 50 kilometres away. This means a detour of 100 km. Under the circumstances this distance is a five-hour trip.

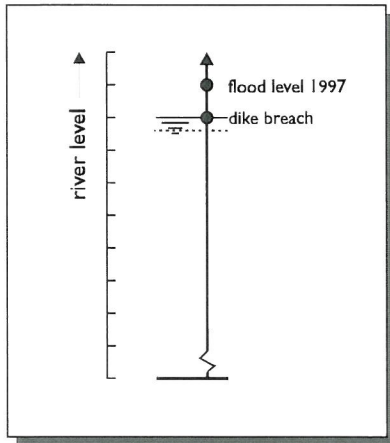
Question 3.1

Which problems do you encounter without the bridge?

Question 3.2

How can you prevent such problems in the future?

Part four: failure mechanisms (15 minutes)



Summary

The water level is only 20 cm below the crest level of the dikes. Due to the lack of sandbags the necessary measures have not been carried out. At all reported trouble locations the situation becomes critical:

- The sand boils are 50 cm high;
- The grass coverage dike at the confluence is damaged badly;
- The crack in the eastern dike is 10 cm wide;
- The wave overlap at the western dike washes away the deposited sand.



Event 4

Several inspection teams report serious danger. The inspection team at the downstream confluence of the river reports that they are going to leave the area since it is becoming too dangerous and a breach can happen any time. The team that has reported the crack in the river dike has not sent in any reports today.

Question 4.1

What emergency measures can you take in this situation if there was no lack of materials?

Question 4.2

If no emergency measures can be taken what else should you do?

Question 4.3

If the situation is this serious when would you leave?

Evaluation (plenary)

Formulate the groups conclusions with respect to this exercise:

- what actors did you miss in the exercise?
- did you enjoy doing the exercise?
- what did you learn?
- would you do this again?

4 Instructions for the facilitators

Purpose of the exercises

The purpose of the exercises is to create an opportunity for discussion for the participants. It is not necessary that the answers to the questions are correct or complete.

About the contents of the exercises

The exercise about risk perception is aimed at creating a feeling of the processes that play a role when decisions have to be taken under an increasing pressure. The exercise about monitoring and emergency measures aims to illustrate how the function of the dikes can be threatened by rising water levels, and to what types of signs the dike inspection teams have to pay attention, and how and when measures can be taken to prevent damage.

Set-up of the exercises

Each exercise consists of a description of the area, a description of the actors and a scenario consisting of events followed by questions. The exercises have been divided into parts. Each part starts with a summary of the current situation followed by one or more events and questions. For each part of the exercise a fixed amount of time is available. Each question should take no more than 5 minutes.

The exercises can be done in small groups, or in a plenary session. If they are done in groups, the groups should consist of people from different organisations.

The role of the facilitator

As a facilitator you should try to create an environment in which the participants feel free to talk and exchange ideas, experience and knowledge. You should try not to get involved in the discussion, your role is to keep an eye on the time and the process.

The exercise

Assigning roles

Before you start the risk perception exercise you should divide the participants into five groups and assign a role to each group. Five roles are available:

- disaster management team;
- head of the local water board;
- mayor;
- rescue forces; and
- citizens.

For the monitoring exercise it is not necessary to let the participants play a role. One of the participants should be asked to write down the group's answer to each question.

Introducing the exercise

- Explain what the area used in the exercises looks like.
- Explain the various actors and their role.
- Explain the figures indicating the current and expected water levels.
- Explain the set-up of the exercise.

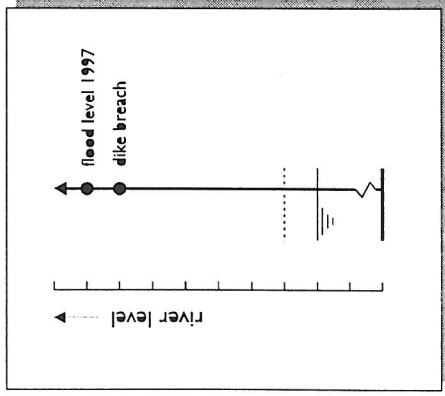
Doing the exercise

- Appoint somebody to write down the groups conclusions/answers.
- Hand out the first part and let each (role) group write down the answer to the questions.
- Discuss the answers and formulate a group answer.
- Hand out the next part of the exercise.
- Continue this way.

A Sheets risk perception exercise

Event I

- Heavy rainfall in upper catchment for a week
- Rumours of coming flood wave



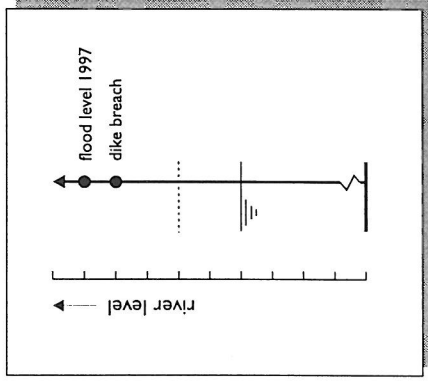
IMGW	Disaster management team	Local water board
Predicts levels like in 1997	Comes together	
Mayor	Rescue forces	Citizens

Questions

- 1.1 What are possible reactions of the citizens to the rumours about the coming flood wave? Write down three possible reactions.

Event 2

- Retention reservoirs on border are filling



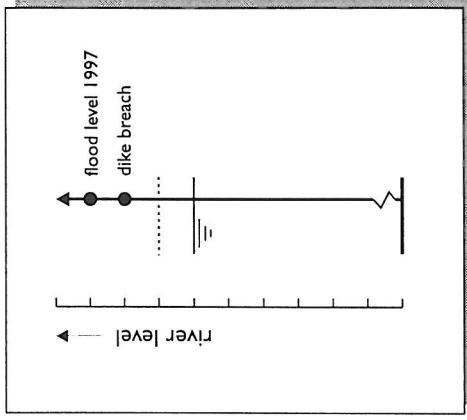
IMGW	Disaster management team	Local water board
<ul style="list-style-type: none"> Predicts more rain Critical levels within 24 hours 		
Mayor	Rescue forces	Citizens
Wants city between river and canal to prepare for evacuation		

Questions

- During the meeting of the disaster management team the fireman proposes to start placing sandbags at locations that were weak spots in 1997. The representative of the local water board thinks this is premature. What do you think? Are any other measures necessary?
- How can the mayor inform the citizens within half an hour that they should be prepared to leave the unsafe areas within four hours?
- What should the mayor advise the citizens to do to prevent as much damage as possible? Write down three things he can advise.
- How do the citizens react to the information that the water levels are rising as high as they were last year?
- What sort of instructions should the rescue forces get at this point? Write down the most important instruction.

Event 3

- Water level one meter below crest of dike
- Retention reservoirs on border full



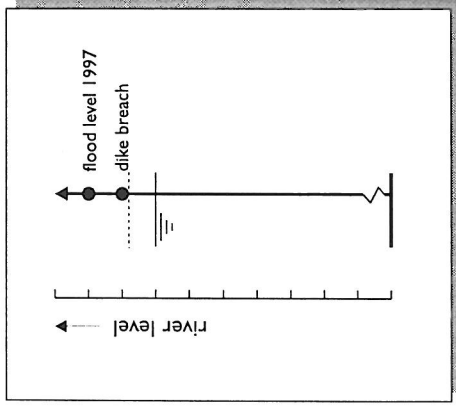
IMGW	Disaster management team	Local water board
	Evacuation seriously considered	
Mayor	Rescue forces	Citizens
Wants to wait filling local reservoir	Alerted by disaster management team	Demand filling local reservoir

Questions

3.1 Considering the latest forecast what should the mayor of Stad do?

Event 4

- Local reservoir filling.
- Evacuation of lower part of city announced



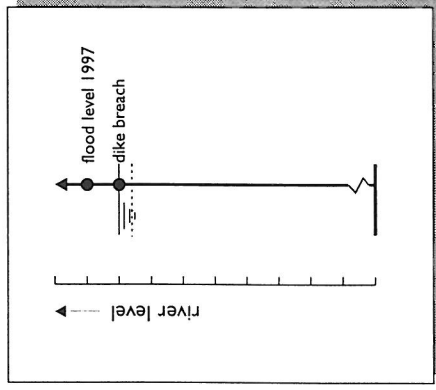
Questions

- 4.1 If you were the mayor, how would you organise an efficient evacuation within one hour?
- 4.2 If you were a company director, how would you react to the news that you have to leave immediately?
- 4.3 If you were the co-ordinator the rescue forces, which three actions would you give most priority to (you can not do everything):
 1. to place sandbags along the weak spots in the river dike;
 2. to prepare an escape route for the evacuation;
 3. to assist in the evacuation of hospitals;
 4. to provide transport for the citizens to safe areas;
 5. to guard evacuated areas;
 6. to remove people that stayed behind in the unsafe areas.

IMGW	Disaster management team	Local water board
Mayor	Rescue forces	Citizens
Announces evacuation		

Event 5

- Rain has stopped
- Western river dike breaks
- Old part of city floods
- Telephone connections no longer available



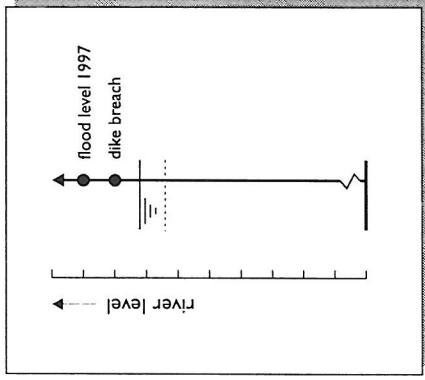
IMGW	Disaster management team	Local water board
Mayor	Rescue forces	Citizens
Announces evacuation		

Questions

- 5.1 You are a member of the disaster management team in the City Hall, what should the disaster management team do according to you and in which order:
1. give the evacuation of the disaster management team priority;
 2. start evacuating the inundated part of the city;
 3. stay where they are (without telephone connections);
 4. give instructions to start closing the gap in the dike.

Event 6

- Water level dropping
- Eastern storm predicted



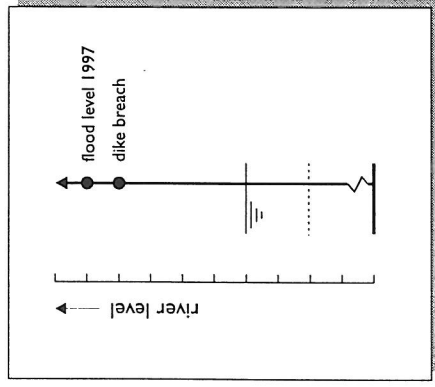
IMGW	Disaster management team	Local water board
	Wants to continue evacuation of inundated city	
Mayor	Rescue forces	Citizens
Wants to stop evacuation of inundated city		

Questions

6.1 What threats does the predicted storm pose?

Event 7

- Water level still dropping
- Inundation only 50 centimetres in city
- Storm at full force
- Breach of western reservoir dike
- Almost whole city inundates



Questions

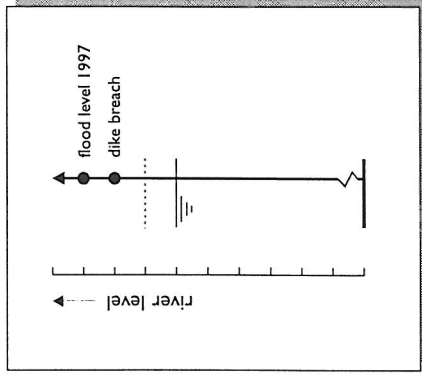
7.1 How could the second flooding have been prevented?

IMGW	Disaster management team	Local water board
Mayor	Rescue forces	Citizens
<ul style="list-style-type: none"> • Has stopped evacuation of inundated area • Has ordered repair of western river dike 		

B Sheets monitoring and emergency measures exercise

Event 1

- Water level 1 metre below crest
- Northerly wind at 5 Beaufort
- Regional reservoir filling up



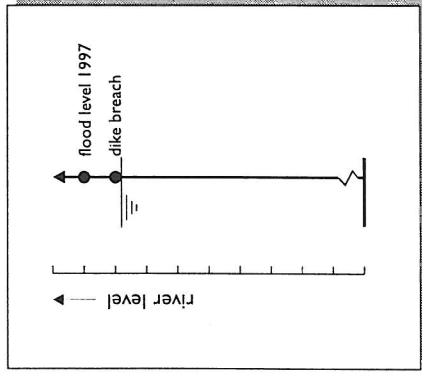
IMGW	Disaster management team	Local water board
Predicts levels will rise Situation critical in 24 hours	Comes together	Started with dike inspection
Farmer	Rescue forces	Inspection teams

Questions

- 1.1 What should the dike inspection teams look for at this stage?
- 1.2 What measure can be taken at this stage to prevent future damage?
- 1.3 Which of these situations reported by the inspection teams would you classify as the most dangerous? Why?

Event 2

- Water level 50 cm below crest
- Regional reservoir full
- Local reservoir filling up



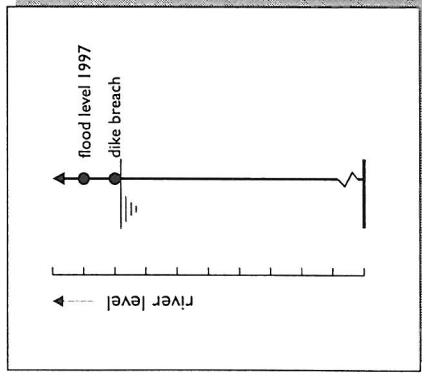
IMGW	Disaster management team	Local water board
Farmer	Rescue forces	Inspection teams
Reports water through dike of reservoir	Reports damage to bridge pylon	Report: seepage, debris, crack, wave overtopping and sand boils

Questions

- 2.1 Which of these situations reported by the inspection teams would you classify as the most dangerous? Why?
- 2.2 The chairman of the disaster management team says the policeman's story is not important. What do you think?
- 1.3 What would you do with the report by the farmer?

Event 3

- Situation becomes worse
- 50% of required sand available
- Bridge collapses



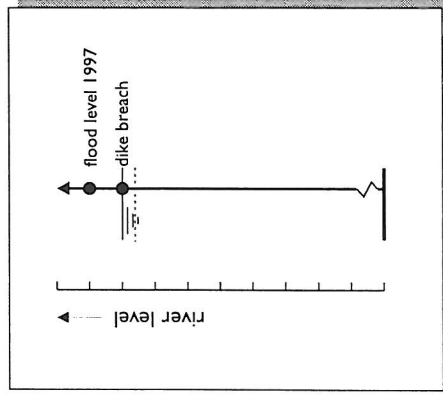
IMGW	Disaster management team	Local water board
	Has ordered sandbags.	
Farmer	Rescue forces	Inspection teams
Reports active sand boils		Crack is now 2.5 cm wide and 20m long

Questions

- 3.1 Which problems do you encounter without the bridge?
- 3.2 How can you prevent such problems in the future?

Event 4

- Dike about to break at confluence
- Inspection teams are leaving



IMGW	Disaster management team	Local water board
	Has ordered sandbags.	
Farmer	Rescue forces	Inspection teams
Sand boils are now 50 cm high		Crack is now 10 cm wide, grass coverage at confluence damaged

Questions

- 4.1 What emergency measures can you take in this situation if there was no lack of materials?
- 4.2 If no emergency measures can be taken what else should you do?
- 4.3 If the situation is this serious when would you leave?



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