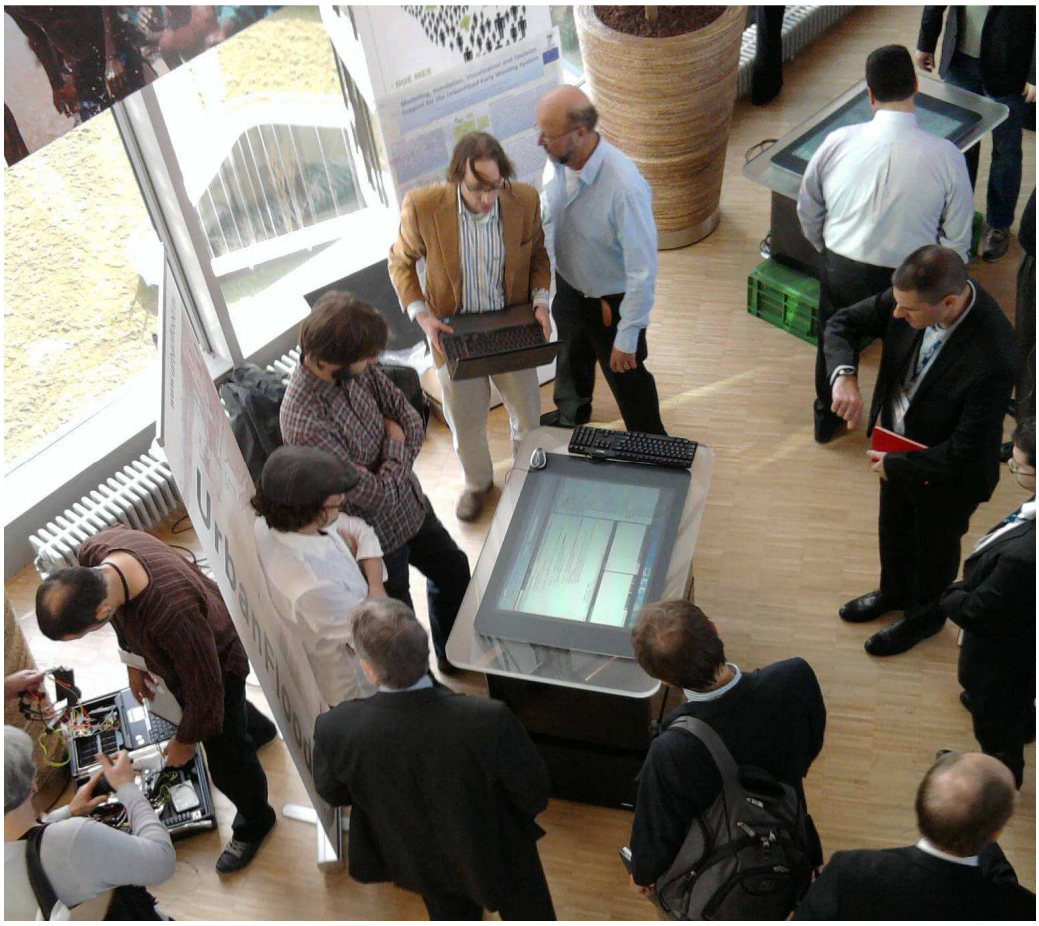
UrbanFlood



D7.9 The impact of UrbanFlood on combating climate change induced disasters

Internal Evaluation

Work Package 7 – D7.9 **version 1.0, date 30/11/2012**

November 2012

URBANFLOOD

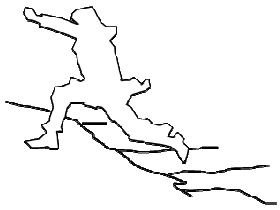


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TABLE OF CONTENT

SUMMARY

This report is the internal evaluation of the UrbanFlood project. It is based on the input of the partners, the advisory board, external experts and the general public. The groundwork for this evaluation is Deliverable 2.3 “Criteria for the evaluation of UrbanFlood”. In this deliverable the actual results are compared with the criteria and evaluated. The overall score is 4,6 on a five point scale, while the minimum score for success was set at 3,0. The most important conclusions are te following:

- UrbanFlood has achieved all its goals and can be proud on the results.
- There is no need for further development of the UrbanFlood system in this setting. It can be deployed in practice. Further developments must be done in that context. UrbanFlood technology might be applied in other FP7 projects or even in Horizon 2020.

Acronyms and Abbreviations

CYF, CY	Cyfronet AGH, Cracow, Poland – UrbanFlood partner
DoW	Description of Work, annex to the UrbanFlood Grant Agreement
EC	European Community
EWS	Early Warning System
FLOODsite	EU funded project: Integrated Flood Risk Analysis and Management Methodologies. 6th Framework Programme
HRW	HR Wallingford
ICT	Information and Communication Technology
IJkdijk	IJkdijk Foundation, dike testing site in Groningen, the Netherlands
LiveDijk	Test location for sensor technologies at Eemshaven, Groningen, the Netherlands
PU	Public (report)
RTD	Research (in DoW)
SIE	Siemens, Germany. OOO Siemens in Russia is an UrbanFlood project partner
SME	Small and Medium sized Enterprise
STOWA, STO	Dutch acronym for the Foundation for Applied Water Research, Utrecht, The Netherlands – UrbanFlood Partner
TNO	TNO Dutch organisation for Applied Research, The Netherlands – UrbanFlood lead partner
UK	United Kingdom
US, USA	United States of America
UvA	University of Amsterdam
WP	Work Package

1 Introduction

1.1 UrbanFlood

UrbanFlood has developed an online early warning system (EWS) technology for climate induced disasters in urban areas with support for real time emergency management and routine asset management. The technology is widely applicable; however UrbanFlood validates it for the case of flood risk management in urban areas. UrbanFlood is funded under the EU 7th framework program. Started in December 2009, the project ran for three years and was successfully concluded by November 2012. Partners of UrbanFlood are TNO, the University of Amsterdam and STOWA (Dutch acronym for the Foundation for Applied Water Research) from the Netherlands; HR Wallingford in the UK, ACC Cyfronet AGH in Poland and OOO Siemens in Russia.

1.2 Challenges

The challenges UrbanFlood faced were formulated as questions at the start of the project in early 2011:

"How can professional organisations connect sensor infrastructures to an Internet-based Early Warning System (EWS), work with that EWS, and integrate this with existing EWS, with decision support, visualisation and public information systems?"

"How do we monitor thousands of sensor streams?"

"How do we create a common information space that allows easy integration, over the Internet with other EWSs, sensors and application programs for public information, decision support?"

"How do we effectively host and manage multiple early warning systems? How can shared, Internet-based facilities for EWS adapt to a sudden demand of computational resources? Can we beneficially use cloud computing resources to introduce new EWS and keep investment in hardware low?"

"How can we create an Internet-based EWS that monitors dikes and integrates that with simulations to measure dike strength and failure, and flood models, as well as with legacy EWS?"

"Is it feasible to monitor dikes on a European scale, from multiple locations?"

Now, at the end of the project, we can truthfully state that answers to the questions have been given in numerous scientific articles, deliverables, conferences, demonstrations and television broadcasts.

1.3 Internal Review and "The Story"

Deliverable D7.9 is the internal evaluation of the project. It was decided to deliver it in two documents:

1. the brochure "UrbanFlood – The Story" that summarizes the achievements for non-experts;
2. This document which is the internal evaluation based on the guidelines set out in D2.3v2.2.

1.4 Structure of this document

Chapter 1 Introduction

Chapter 2 Internal evaluation of UrbanFlood

Chapter 3 Conclusions

2 Internal evaluation of UrbanFlood

The objective of Work Package 2 as stated in the Description of Work (DoW) was to: *Identify typical capabilities, requirements and usage scenarios of the early warning system (EWS) from experts, authorities and citizens. Evaluate the UrbanFlood results.*

This resulted in the drafting of D2.3: "Guidelines for the Evaluation of UrbanFlood", subtitled: "With a state of the art description", finalised and submitted in May 2012.

The actual internal evaluation of UrbanFlood is a task under WP7 carried out by all partners under the responsibility of lead partner TNO. The evaluation took place in November 2012 (Deliverable 7.9, Task 7.7), with the input of external experts, where required. In the next paragraphs the results of the evaluation are presented in tables, taken from D2.3. And the total score is calculated

2.1 Evaluation of UrbanFlood, as a whole

This table contains the overall score of urban flood, based on the detailed scores in the tables from the next paragraphs.

The evaluation of UrbanFlood considers that	Points 0 to 5	Weight
the project has performed all its tasks	A **5,00**	0,5
the project has achieved its objectives,	B **4,32**	0,1
the project has realized progress beyond the state of the art	C **5,00**	0,1
the project has achieved its expected European impact	D **3,71**	0,1
the technology is suitable as an early warning system for dike failures	E **4,00**	0,2
UrbanFlood is successfully evaluated F > 3 (F=0,5A+0,1B+0,1C+0,1D+0,2E)	**F 4,60**	

2.2 Evaluation of tasks

Annex 3 contains a list of tasks. Task completion leads to the completion of deliverables and the achievement of milestones. The evaluation of deliverables and milestones is done by the review committee annually.

	Points 0 to 5	Weight
All deliverables and milestones are accepted by reviewers ***All milestones have been reached, all deliverable submitted, almost all specifications (see annex 6)have been implemented***	A **5**	1
		5,00

2.3 Evaluation of objectives

Annex 1 reproduces UrbanFloods objectives from the DoW B1.1.2.

The project has achieved its objectives	Points 0 to 5	Weight
Objective 1: Determine, with hindsight, the relevance and coherence of the specification of UrbanFlood technology. • 5*the fraction of appropriate (2012) specification items in Annex 6 in a joint evaluation of UrbanFlood members and two external experts ***See annex 6 for scores on specifications***	B1 **4,6**	1/5 **0,93**
Objective 2: Evaluate the UrbanFlood technology in the field per monitored site, in a joint evaluation of UrbanFlood members and two external experts the following characteristics are evaluated after 1-7-2012: 1. the cost of the technology is, for large scale, less than 10% of the cost of dike building/improvement, 0-1 point ***See Business case in annex 7.*** ***Quote from Peter Jansen (Waternet): "By investing €100,000 in sensor systems we saved €20,000,000 on dike improvements"*** 2. the whole UrbanFlood system was online for more than 95% of the planned uptime, 0-1 point ***Not realized: Sensors in Boston and Amsterdam have been out of operation for some weeks*** ***3.*** the AI of EWS works 95% of the planned uptime, 0-1 ***Realized.*** 4. the experts can use the 10 most important features of the UI, 0-1 point ➢ Provide Early Warning o Understanding Alarm levels	B2 **1** **0** **1** **1**	2/5 **1,20**

○ Overview of all locations and alarms ○ Overview of all timeslots with anomalies ➢ Performing diagnosis ○ Explore location ○ Show geographical information ○ Compare different graphs ○ Run stability simulations ➢ Making decisions ○ Run Inundation models ○ Run Evacuation models ○ Create and share strategy with other devices ***Realized (observations during numerous demos***		
5. 75% of the groups that visit the UrbanFlood visitor centre interacts with the multi-touch table, 0-1 point ***This is not measurable. However public exposure in The Crystal is much better than any expected visitor centre***	**0,5**	
Objective 3 Evaluate UrbanFlood technology as an Internet Society technology UrbanFlood 1. uses Internet to transport data between dikes, visitor centres and UrbanFlood data centres, 0-1 point 2. uses cloud computing services, 0-1 point 3. supports mobile phones, 0-1 point 4. supports mobile computers, 0-1 point 5. uses social media, 0-1 point ***All realized. See demo*** ***1: By design*** ***2: By design*** ***3: SMS to users with early warning*** ***4: application runs on windows8 tablet*** ***5: show twitter data***	B3 **1** **1** **1** **1** **1**	1/5 **1,0**
Objective 4 Evaluate the openness of UrbanFlood technology ***Implementation matches with the agreements on IPR where the openness was specified.*** ***See annex 7 for a complete overview of availability***	B4 **5**	1/5 **1**
B=(B1+2B2+B3+B4)/5	**B**	**4,32**

2.4 Evaluation of "progress beyond the state of the art"

The state of the art is described in DoW B 1.2 and that is repeated in Annex 2 . The annex shows that the determination of the progress is mainly covered through the evaluation of deliverables and milestones, see Section 2.2.

Progress beyond the state of the art	Points 0 to 5	Weight
Progress, on a system level, as described in Section Error! Reference source not found.: • UrbanFlood EWS monitor, in real time, the condition of dikes, 0 – 2 points ***Implemented (see demo)*** • UrbanFlood EWS do calculate risks based on real time measurements of dike conditions, 0-3 points ***Implemented (see demo)***	C1 **2** **3**	¼ **1,25**
Progress from a flood management teams perspective, Section Error! Reference source not found. • UrbanFlood risk assessment software does take into account the actual real time condition in dikes, 0-1 point ***Implemented (see demo)*** UrbanFlood WS offers the management team of a flood event • an EWS that provides specific flood defence condition data in real time, 0-1 point, ***Implemented (see demo)*** • along with the associated mapping should failure occur, or be occurring, 0-1 point ***Implemented (see demo)*** • There are developments which enable software models to calculate observables, 0-2 points ***Implemented (see demo virtual dike)***	C2 **1** **1** **1** **2**	¼ **1,25**
Progress from a technology point of view (D2.3 Error! Reference source not found.**)** • 5 * the fraction of realized items in **Error! Reference source not found.** - EWS based on an ESB - General purpose EWS Platform based on web services and cloud services - Visualisation support for the decision taking - Common Information Space based on web	C3 **5**	¼ **1,25**

services and cloud services - Cloud services, virtualisation technology - Web publishing - Plug-Ins - Artificial Intelligence based anomaly detection - Common Information Space - Inundation Models - Decision support system (with visualisation) - Breach Models - Virtual Dike ***All items have been realized (see D5.5, D4.3, D6.6 and demo)***		
Progress on baseline summary for building blocks of the UrbanFlood AMS/EWS (D2.3 Error! Reference source not found.) 5 * the fraction of realized progress on the following points: 1. EWS – a group of virtual images forming a general purpose EWS ***Realized (see demo)*** 2. General Purpose EWS facility as a service that generates on demand an EWS ***Realized (see demo)*** 3. Visualisation support for the decision taking with multi touch tables ***Realized (see demo)*** 4. Common Information Space as a web service ***Realized (see demo)*** 5. EWS facilities that use cloud computer capacity ***Realized (see demo)*** 6. Artificial Intelligence based anomaly detection as a service ***Realized (see demo)*** 7. Common Information Space as web service ***Realized (see demo)*** 8. Inundation Models linked to sensor networks in dikes ***Realized, interactive user intervention for decision making purposes is allowed*** 9. Breaching Models linked to sensor networks in dikes ***Realized, interactive user intervention for decision making purposes is allowed*** **10.** Virtual Dike can be used via Internet ***By uploading configuration files through SSH***	C4 **1** **1** **1** **1** **1** **1** **1** **1** **1**	¼ **0,875**

C=(C1+C2+C3+C4)/4	C	**5,00**

2.5 Evaluation of expected European impact

The expectations of the impact of UrbanFlood are defined in the FP7 EC work program, call 6.4 "**Objective ICT-2009.6.4 ICT for Environmental Services and Climate Change Adaptation"**. An overview of the expected impact is given in annex

Evaluation of expected European impact done by UrbanFlood experts in D7.7	Points 0 to 5	Weight
UrbanFlood contribution to expected impact • 5 * the fraction of the number of successful evaluations specified in Annex 5	D1 **5**	1/7 **0,72**
DoW 3.1.1 Impact on the competitiveness of the proposers • **DoW 3.1.1.1 Direct applications and market prospects,** 5*the fraction of five of the number market applications, prospects and research projects and proposals at the end of 2012 - ***Subsidy from Province Groningen for Dike Data Service Centre (TNO) (already funded)*** - ***EIT (ICT labs) proposal submitted and received B-ranking (meaning: likely to be funded)*** - ***Serious lead in Thailand (TNO, HRW, Siemens)*** - ***Proposal for FP7 ICT-2013.6.3 ICT for water resource management in preparation (TNO, Cyfronet, UvA, Siemens, STOWA, HRW)*** - ***Serious lead for monitoring Reservoir dams in the UK (HRW)*** - ***Serious lead for continuation of monitoring the dike in Boston with Environment Agency*** - ***Serious lead for continuation of monitoring the dike in Amsterdam with Waternet***	D2 **5**	1/7 **0,72**
• **DoW 3.1.1.3 Economic justification** Letters written by an non UrbanFlood experts detailing the economic rationale for the monitoring of (each 1 point and summed up): 1. channel/river dikes, ***(See Annex 12)*** 2. sea dikes, ***(See Annex 12)*** 3. dams of mine tailings, 4. other dams, and ***5.*** mountain slopes	D3 **2**	1/7 **0,29**

3-5 are plausible, but no evidence available		
3.2 Dissemination and/or exploitation of project results, and management of intellectual property X=0, 1=perhaps, 2=under discussion, 3=business/R&D project development activities, 4=budgets are reserved, 5=concrete activities • **DoW 3.2.1.1 Industrial and commercial routes for exploitation** o Siemens commercializes UrbanFlood results, X	D4 **3**	1/7 **0,43**
o HR Wallingford commercializes UrbanFlood results, X	D5 **3**	1/7 **0,43**
o 5 * the fraction of non-commercial partners that, in 2012 and 2013 put effort in the exploitation the results (in any form) after the completion of the project *TNO, Cyfronet, UvA, STOWA*	D6 **3**	1/7 **0,43**
• **3.2.1.2 Validation of the technology** • 5 * the fraction of a total of 5 of letters of intent with non-UrbanFlood partners for continuation of cooperation with consortium members *Score is based on mails from:* *Tarek Abdoun* *Mike Mooney* *Mike Sharp* *Environment Agency* *Peter Jansen (Waternet)* *See Annex 11*	D7 **5**	1/7 **0,72**
D=(D1+D2+…D7)/7	D	**3,71**

2.6 Evaluation of the suitability of the technology as an early warning system for dike failures

Evaluation of the suitability of the technology as an early warning system for dike failures	Points 0 to 5	Weight
Opinion of participants at the third International Online EWS Workshop October 2012 • 5 * the fraction of positive conclusions of interviews	E1 **4**	0,2

of at least 10 participants ***Results questionnaire visitors FloodRisk (Annex 10) n=24***		
Opinion of the advisory board • 5 * the fraction of positive conclusions of interviews of all members ***Results questionnaire AB menber(Annex 10)***	E2 **5**	0,4
Opinions of practitioners (like water boards and other authorities) • 5 * the fraction of positive conclusions of 10 interviews in at least 5 countries ***Results from questionnaires by specialists from Flood Risk and HRW Road Shows (Annex 10 and D3.3)***	E3 **4**	0,1
Opinions of the general public in visitor centres • 5 * the fraction of positive conclusions of interviews of 10 visitors in 3 countries ***See D3.3 This sore is based only upon the results in the Boston Visitor Centre. In the other three no systematic reactions from the general public were registered.***	E4 **3**	0,2
Opinions of participating as well as non-participating SMEs on the business potential and the usability of the UrbanFlood technology • 5 * the fraction of positive conclusions of 10 interviews of SME's ***Score is based on mails from:*** ***Erik Peters (Alert Solutions)*** ***Jurgen Dornstadter (GTC Kappelmeijer)*** ***Harrie Bos (DMC systems)*** ***Wouter Zomer (BZIM)*** ***See Annex 12***	E5 **4**	0,1
E=0,2E1+0,4E2+0,1E3+0,2E4+0,1E5	E	**4.00**

2.7 Overall result of the detailed evaluation

From the table in paragraph 2.1 it can be concluded that UrbanFlood is evaluated very positive. The overall score is 4.65 on a five point scale, while the minimum score for success was set at 3.00

3 Conclusions

In this chapter the most important conclusions from the evaluation are summed up and commented in this chapter

- UrbanFlood has reached all its goals within the budget.
- UrbanFlood can be proud on its results.
- There is no need for further development of the UrbanFlood system in this setting. It can be deployed in practice. Further developments must be done in that context. UrbanFlood technology might be applied in other FP7 projects or even in Horizon 2020.
- Essential UrbanFlood artificial intelligence and finite element software have been successfully validated in the last IJkdijk experiments. Here a number of sensor equipped dikes were deliberately loaded until they collapsed. The UrbanFlood technologies successfully forecasted the moment of failures.
- At least half of the partners plan commercial activities on basis of UrbanFlood technologies. There are already several commercial leads (total value > 20M€).
- The UrbanFlood partners prepare a MoU for commercial activities and keep the system running at least for 2013 and 2014.
- Transfer of the open source components of the UrbanFlood software to the Dike Data Service Centre of the IJkdijk Foundation will be investigated. TNO and STOWA are involved at board and management level in this foundation.
- The project has received a lot of media attention. BBC World News (Horizons), Zweites Deutches Fernsehen (Drehscheibe) and the Dutch TV (Netherlands From Above) did items on Urban Flood. Recently three other TV agencies have shown interest in making an item about UrbanFlood: EURONEWS, NTR and Xinhua News Agency. The project has a permanent display at “the Crystal sustainability centre” in London.
- Finally it was a lot of fun to work with all consortium members. The cooperation went smoothly and all partners were very much committed to the project.

Annex 1 Objectives, DoW B1.1.2

Objective 1: Identify typical capabilities, requirements and usage scenarios of the early warning system (EWS) from experts, authorities and citizens. Evaluate the UrbanFlood results.	Evaluate specification and realisation of UrbanFlood results.
Objective 2: Install, operate, and maintain sensor networks in London, Amsterdam, St Petersburg and a field lab. Evaluate the EWS. Create Internet based general purpose monitoring modules on the basis of AI that will learn to detect patterns that signal the development of potentially harmful scenarios	Evaluate the UrbanFlood technology in the field
Objective 3: Create specific decision support, computational and visualisation services for dikes. Combine this with other online public and private information. Create data generators for testing, mitigation planning and training purposes. Use an online model, called Virtual Dike, to simulate several dike breaching scenarios to explain the sensor data and compute the consequences of breaching. Model the (eventual) flood spreading process as well as a damage assessment of the affected city	Evaluate UrbanFlood decision support system
Objective 4: Create an Internet based, common information space (CIS) that interfaces with GEOSS systems. The CIS interfaces, amongst others with the sensor networks, the monitor system computing facilities, the decision support systems, command and control centres and public information systems.	Evaluate UrbanFloods ability to interwork other systems
Objective 5: Test the UrbanFlood, Internet based EWS in the context of the existing EWS of leading stakeholders.	Evaluate if, and if so how much, the UrbanFlood system is perceived as progress compared to the systems in use at the waterboards.

Annex 2 Progress beyond the state-of-the-art, DoW B1.2

Baseline	UrbanFlood Advances	Definition of criteria and "performance/ research indicators
ICT to combat the effects of climate change		
Limited number of concepts in which ICT is used to combat the effects of climate change. Most of them seem to target energy savings and mobility. Lack of attention of harvesting Internet technologies and the Internet connectivity to enhance the power of EWS and cooperation between nations.	**UrbanFlood's main innovation is the creation of an online, scalable, general purpose system that is able to host early warning systems.** **Objective 1: Identify typical capabilities, requirements and usage scenarios of the early warning system (EWS) from experts, authorities and citizens. Evaluate the UrbanFlood results.** **Objective 5: Test the UrbanFlood, Internet based EWS in the context of the existing EWS of leading stakeholders.**	**UrbanFlood will demonstrate the EWS at prominent public places** M10 EWS has full functionality M11 First intercontinental dike monitoring is fact, press conference D2.1 EWS and the mitigation of Climate Change induced disasters M12 At the "Final Event" the results of UrbanFlood are presented D2.2 Functionality and architecture of internet based EWS and EWS hosting platforms D2.3Guidelines for the evaluation of UrbanFlood D6.1 Basic remote dike monitor D7.8 The impact of UrbanFlood on combating climate change induced disasters

Mitigate Flooding		
Flood risk calculations based on an incidental characterization of the geophysical properties of dikes. The information is static and not changed until the next inspection Models create the maps that indicate, as a function of the weather situation, risks.	**UrbanFlood will increase the accuracy of flood risk calculations to new unprecedented levels.**	M4 Risk models take sensor data into account D3.3 Experiences with online dike monitoring systems
Flood protection is based on physical structures (e.g. dikes) whose expected performance is based on gut feelings and on model calculations. First principles calculations (based e.g. on microscopic models of clay) are computationally too intensive, whilst phenomenological models lack calibration. For the overwhelming number of dikes, financial, geospatial and technical barriers limit their further strengthening. Authorities and public can see risks on wall maps and computer screens but rely on unreliable visible inspection (e.g. during storms). Being proactive at the proper place is difficult.	**Objective 2: Install, operate, and maintain sensor networks in London, Amsterdam, St Petersburg and a field lab. Evaluate the EWS. Create Internet based general purpose monitoring modules on the basis of AI that will learn to detect patterns that signal the development of potentially harmful scenarios**	M1 Two dikes online M2 Three dikes online. M3 The monitor system is robust and is able to detect anomalous conditions in dikes D3.1 Online dikes, installation and Artificial Intelligence D3.2 Signal processing of sensor networks in dikes D7.7 Deploying Internet services to combat climate change induced disasters

EWS service		
The EU and INTERREG funded project FLAPP (Flood Awareness and Prevention Policy in border areas) published in 2007 an overview[1] and stated that *"Flow of data and information between trans-boundary river catchments are still often obstructed as the result of non-compatible flood information systems on either side of the border. Moreover, even within one country a too great diversity of non-communicating systems exists*	**UrbanFloods main innovation is the creation of an online, scalable, general purpose system that is able to host early warning systems** **Objective 4: Create an Internet based, common information space (CIS) that interfaces with GEOSS systems. The CIS interfaces, amongst others with the sensor networks, the monitor system computing facilities, the decision support systems, command and control centres and public information systems.**	M10 EWS has full functionality M8 The CIS has been demonstrated to SEIS and INSPIRE representatives M10 EWS has full functionality D4.3 Experiences with an online decision support system for flood control D5.5 Common Information Space technology for Europe 7.4 Acceptance of Internet services to combat climate change induced disasters D7.5 D7.8 D 7.10 Proceedings of the First, Second and Third International Online Early Warning System Workshop D7.6 Video "Internet services to combat climate change induced disasters"

[1] www.flapp.org/upload/122/Documenten/Inventory%20of%20existing%20flood%20information%20systems%20in%20Europe.pdf

There are sensor systems being developed for dikes (especially in the IJkdijk project) however, EWS that connect to sensor networks are absent.	**Objective 3: Create specific decision support, computational and visualisation services for dikes. Combine this with other online public and private information. Create data generators for testing, mitigation planning and training purposes. Use an online model, called Virtual Dike, to simulate several dike breaching scenarios to explain the sensor data and compute the consequences of breaching. Model the (eventual) flood spreading process as well as a damage assessment of the affected city**	M5 Virtual Dike calculates sensor responses D4.1 The design and prototyping of a decision support system for flood control D4.2 An internet based decision support system for flood control D6.2 Operational Internet DSS viewers
Existing EWS do not have inputs from in-situ sensor networks and cannot monitor the onset of failure mechanisms directly.	**UrbanFlood will enable decision support on the basis of in-situ sensor data, and scenario based calculations on a multi-touch table to create a multi-person situational awareness environment.**	D6.4 Monitoring, rich browsers and cloud service technologies for an online EWS hosting platform
No interworking	**UrbanFloods EWS allows the interworking of various teams of decision takers and experts at multiple locations.**	D6.6 Internet services for EWS

<table>
<tr><th colspan="3">ICT</th></tr>
<tr><td rowspan="3">The constructors of shared online facilities face the challenge of creating a flexible, robust and scalable system that can integrate with external sensor networks and computer systems.

Such a platform for EWSs does not exist, not in the general, not in the case of being able to host many EWSs, nor in the specific case of flooding, nor in the case of using Internet services and common information spaces.</td><td>UrbanFloods main innovation is the creation of an online, scalable, general purpose system that is able to host early warning systems</td><td rowspan="2">M6 The CIS integrates the (distributed) software modules of the EWS

M8 Prototype EWS with plug in technology working

M9 Prototype EWS with plug in technology working

D5.1Common Information Spaces (description of state of the art and future developments)

D5.2 Specification of the architecture and interfaces of the Common Information Space

D5.3 Orchestrating the information flow in a Common Information Space

D5.4 Orchestrating (super)computing resources of the Common information space

D6.3 Plug in technology to wrap EWS components into containers that can be handled by the CIS</td></tr>
<tr><td>UrbanFlood uses application virtualisation technologies to create extremely scalable and flexible online EWS technologies able to allocate Internet based computing resources on demand.</td></tr>
<tr><td>UrbanFlood will create AI technologies that are capable of monitoring the large amount of sensor data from dikes.</td><td>M3 The monitor system is robust and is able to detect anomalous conditions in dikes</td></tr>
<tr><td>The usage of the online facilities of others was pioneered in the exact sciences. The European IST project Virolab[2], for instance, created the “GridSpace[3] virtual laboratory (VL)”, a set of integrated components that, used together, form a distributed and collaborative space for science.</td><td>UrbanFloods EWS platform will use commercial and academic computer resources through the Internet.</td><td>M7 The CIS manages (online) computing resources

D6.5 Running multiple EWS on distributed clouds</td></tr>
</table>

[2] www.virolab.org, EU IST STREP Project027446

Annex 3 Indicators of success per task.

Review 1 and 2 commented that the success indicators for a task where not pertinent and requested improvements. In the table below, a success indicator is mostly an accepted deliverable and milestone reached. UrbanFlood then must provide information "evidence" with which a deliverable or milestone can be validated. This information in specified in Annex 4

Task	Task description/Criteria	Indicator (A="acceptance")
2.1	*Describe the state of the art*	**A** D2.1
2.2	*Describe demand for online EWS and smart dikes*	**A** D2.1 Installation of Advisory board.
2.3	*Describe EWS requirements*	**A** D2.2
2.4	*Determine evaluation criteria for impact analysis*	**A** D2.3
3.1	*Design the sensor networks*	**A** D3.1a
3.2	*Build and operate the sensor networks*	**A** D3.1a
3.3	*Develop monitoring system*	**A** D3.1b
3.4	*Signal processing and interpretation* AI capable of detecting anomalous dike conditions	**A** D3.2 D3.3 **A** MS1 MS2 MS3
4.1	*Adapt models to sensor data and the EWS*	**A** D4.2 D4.3 **A** MS4
4.2	*Develop Virtual Dike model*	**A** D4.2 D4.3 **A** MS5
4.3	*Develop visualization software*	**A** D4.2 D4.3
4.4	*Develop decision support system*	**A** D4.1 D4.2 D4.3 **A** MS5
5.1	*Develop the execution framework*	**A** D5.1 to D5.5 D6.3 **A** MS6 MS7 MS8
5.2	*Develop the event infrastructure*	**A** D5.1 to D5.5
5.3	*Develop the provenance logging service*	**A** D5.1 to D5.5
5.4	*Develop the CIS user and developer GUIs*	**A** D5.1 to D5.5

[3]Grid Space demo homepage: http://gs.cyfronet.pl

6.1	*Develop basic signal monitor system*	**A** D6.1
6.2	*Research and develop plug-in technology*	**A** D6.3, D6.4
6.3	*Design EWS hosting platform*	**A** D.3, D6.4, D6.5
6.4	*Create the EWS hosting platform*	**A** D6.5
6.5	*Develop Internet DSS*	**A** D6.2 D6.6 **A** MS9 MS10
7.1	*Dissemination activities*	**A** D7.1 to D7.9 **A** MS11 MS12
7.2	*Exploitation activities*	**A** D7.3 D7.4
7.3	*Usability evaluation*	**A** D 7.3 D7.9
7.4	*Advisory Board activities*	**A** D7.9
7.5	*Participate in IJkdijk experiment*	**A** MS3
7.6	*Standardization activities*	**A** MS8
7.7	*Impact analysis* UrbanFlood successful evaluated	**A** MS10 MS12

Annex 4 Validation of deliverables

The evaluation of tasks is related to the acceptance of deliverables and milestones. Deliverables and milestones are the concrete output and results of one or more tasks. Furthermore, the reviewers repeatedly asked for "evidence", information with which they can evaluate if claims made in deliverables, and, indeed, the promises made in the description of work are appropriate. This has taken a while to grasp. The reviewers referred to a standard set of evaluation criteria like[4], which we adapted to the UrbanFlood context. A table containing evidence related to the claims in the deliverable and mile stone will be part of every deliverable of Y3. The format of the table is presented in the table below. For the current deliverable D7.9 it is presented in annex 9.

Table 1 Format of evaluation criteria and a description of evidence for deliverables and milestones.

Evaluation criteria	Evidence
Relevance	showing the extent to which the deliverable contributes to the UrbanFlood goal
Efficiency	showing the amount of MM and resources spent in relation to the planned results.
Effectiveness	showing the extent to which the objectives were achieved, or are expected to be achieved, and related to the WP task list, deliverable and milestone list
Impacts	being a qualified description in how far the deliverable progresses the UrbanFlood project to its goal.
Sustainability	being a list of efforts for the continuation of the results described in the deliverable in the forthcoming years, after the UrbanFlood task is completed.
Coherence	description of the relevance of the deliverable for external stakeholders mentioned in **Error! Reference source not found.**
Quality	where appropriate a list of descriptions, performance tests, requirement checks, interworking tests, model cross validations, publications, interviews, expert opinions, interviews, experimental outcomes

[4] http://web.undp.org/evaluation/handbook/ch7-4.html

Annex 5 Expected European Impact

The expectations of the impact of UrbanFlood are defined in the FP7 EC work program, call 6.4 "**Objective ICT-2009.6.4 ICT for Environmental Services and Climate Change Adaptation". T**hat description is reprinted below, where evaluations are numbered.

Deliverable D7.7, lists and provides proofs of these evaluations.

Table 2 A description how UrbanFlood achieves European Impact

Expected impact	UrbanFlood contribution
Contribution to a Single Information Space in Europe for the Environment (SISE)[5] in which environmental actors, service providers and citizens can collaborate through improved systems connectivity and semantic interoperability. At the same time, contribution to the development of the Shared Environmental Information System[6] (SEIS) and support to the implementation of the INSPIRE Directive[7].	UrbanFlood creates 1. a hosting platform for EWSs. A major component of every hosted EWS is 2. a Common Information Space (CIS) (created by WP5) that 3. has the ability to interface with other CISs. 4. The technology is open source 5. and WP 5 contributes this to the implementation of the Inspire directive.
Reinforced European leadership in ICT solutions for interacting environmental service nodes on the Web, and resulting new market perspectives for environmental and crisis management services.	UrbanFlood creates an online hosting environment for EWSs taking full profit from contemporary Web developments, 6. like service oriented architectures, 7. cloud computing, 8. and above all, Internet proliferation. Hosted EWSs connect to in situ sensor networks where

[5] http://cordis.europa.eu/fp7/ict/sustainable-growth/workshops_en.html

[6] (COM (2008) 46 final), http://ec.europa.eu/environment/seis/index.htm

[7] DIRECTIVE 2007/2/EC, http://inspire.jrc.ec.europa.eu/

	ever they are 9. in Europe, or, 10. indeed in the world. 11. The setup time of a new EWS is short once a EWS for a given type of hazard is populated on the platform. (for anomaly detection, 10% of the time to prepare, install and connect the insitu sensor-systems. Virtual dike calculations are limited by the number of experts and can be made only for a limited amount of segments, once anomalies are detected and within a couple of days (before failure)) UrbanFlood starts with EWSs for flooding; this means that companies who sell dike monitoring systems 12. can deliver EWS services with a minimum additional effort. UrbanFloods EWS technologies take care of interoperability issues and the SISE as well. Hence, UrbanFlood contributes 13. to the creation of a world wide market for European Companies for dike monitoring and flood protection and to the formation of a 14. Shared Environmental Information System.
Reinforced role of ICT in establishing sustainable cities, leading to higher environmental performance in urban areas and better living environments for Europe's citizens.	Dikes that protect cities against flooding are usually to weak, not to low. Dikes are in many cases enormous infrastructures. For the defence of a single city of 1 Million inhabitant 200kms or more are needed – and one weak spot means a disaster. Through in situ sensor networks, artificial intelligence and super computers 15. these weak spots can be traced down as experiments at the IJkdijk field lab have shown.
Strengthened European capacity to mitigate impacts of urban disasters, to save	The hosting environment accelerates the development of early warning systems for all types of hazard, and for flooding in particular. The UrbanFlood hosting

lives and to protect critical urban infrastructures.	environment offers 16. economies of scale and scope. In the case of flooding UrbanFlood accelerates the usage of dike monitor systems. With these in place, authorities, citizens and owners of infrastructures are 17. notified up to two days in advance (IJkdijk results) of potential weak spots in dikes.
Stronger position of Europe with respect to the implementation of international environmental commitments.	The EWS hosting platform 18. can be used to monitor the environment for all kinds of changes. 19. New monitoring activities can be implemented with a minimum of time. The connection to the Internet and its ability to deploy in situ sensor networks allows to monitor everywhere in the world. Even better, 20. it would allow Europe *to offer* specific countries to monitor the environment.

Annex 6 List of specifications: results & expert opinions

List of specifications

The list of specifications below is taken from Annex 1 of the UrbanFlood report "Functionality & Architect ure of Internet Based EWS and EWS Hosting Platforms" (D2.2). The column marked "Score and remarks" refers to the extent to which the specification has been realize in the final version of the UrbaFlood system (1.0 is fully realized)

No	Specification	Score and remarks	External Expert A	External Expert B
1	By using modern sensor and internet technologies, the UrbanFlood EWS must allow the estimation of dike reliability and hence flood risk to be much more accurate and timely.	**1.0** **All relevant HRW models have been implemented: Reliable 2, HR breach, Inundation and Evacuation model.**	**R/C** **Relevant! The risk of flooding is derived from the norm, depending on the value of the protected area**	**R/C** **Vulnerable to loss of sensors and connection - no back up communication lines**
2	UrbanFlood exploits the internet and internet based services to create a powerful yet cost effective EWS.	**1.0** **EWS costs a fraction of dike reinforcement**	**Relevant! Internet is indispensable. What about back up if it fails??**	**For most situations this is a cost effective way, while the UF EWS is powerful indeed. But when the system is needed most, the chances on failure of the Internet are much higher than on average.**
3	The sensors and the Urbanflood EWS must be able to detect a selection of major failure mechanisms of dikes. The EWS must be extensible to detect others.	**1.0** **Implemented for Piping and Stability. Not for overtopping**	**Relevant!**	**Is the system able to detect other failure modes than designed for when these occur? Or will this only lead to misinterpretation**
4	The EWS should provide a number of functional modes such as routine asset management, event simulation and event management capabilities to assist stakeholders in routine working, event planning and event management.	**1.0** **All mentioned modes are implemented**	**Relevant! Asset mgt is of the utmost importance for the long term. It can prepare for a disaster**	**Very well. Incorporation of such a system in daily work routine is extremely important for successful implementation**
5	An EWS should provide the capacity for automated, round the clock, electronic enhancement of dike inspection processes. (In a most basic form this information will indicate dikes requiring maintenance.)	**0.75** **Basically implemented**	**Relevant! It depends on the dike and its purpose (see 1) A real EWS needs 7*24*365**	**Availability as a support tool round the clock: the fully automated part may misguide, the expert indicated in the UF work flow is not always available.**
6	The design of an EWS must be such that for every stakeholder the added value has the same relationship to the investment in the EWS.	**1.0** **System is "financially scalable"**	**Relevant! It is already in the norm (value of protected area)**	**Implementation of the system and training of people may not be in balance for smaller stakeholders**

No	Specification	Score and remarks	External Expert A	External Expert B
7	The UrbanFlood EWS should offer stakeholders straightforward economies of scale and scope.	**1.0** **"By design"**	**Relevant! By definition**	**Including more assets (levees) into the system clearly gives benefits to the stakeholder with the UF EWS. But what about the initial threshold? Is it affordable to start with a small portion of a levee only, as a pilot project?**
8	The EWS should be developed such that it can be offered as a service, and specialized service providers may exploit it as an online service.	**1.0** **Fully implemented**	**Relevant!**	**This is very relevant to overcome initial implementation issues. It is implemented, but are there any such service providers already**
9	The EWS platform should be operated as a shared service.	**1.0** **Fully implemented**	**Relevant! Compare to Ijkdijk DDSC**	**In line with other specifications**
10	Multiple EWS share the same resources.	**1.0** **Fully implemented**	**Relevant! Compare to Ijkdijk DDSC**	**The UF structure enables this, so further 'down the line' competitive services can be used. What to do with conflicting advice, like 'alarm' by one system and 'nothing special' by the other system?**
11	Resources to support EWS operations at peak times should be obtained, via the internet, from cloud computing service providers.	**1.0** **Fully implemented**	**Relevant! For me too technical. But you must be prepared for the peak**	**Important, but vulnerable to availability when needed**
12	The EWS should maximize its market by providing an internet based service.	**1.0** **Fully implemented**	**Relevant! Compare to Ijkdijk DDSC**	**By offering an alternative too, its market may be enlarged**
13	An EWS should be constructed in such way that several suppliers can deliver, in competition, parts of an EWS.	**1.0** **Fully implemented (e.g. models repository)**	**Relevant! Compare to Ijkdijk DDSC**	**Relevant as applicability and relevance of models differs by region**
14	The EWS should provide information on the actual condition of the dikes	**1.0** **Fully implemented**	**Relevant! EWS is for calamities but als for normal management**	**To know the (near) future condition is even more relevant. Can forecasts be made**
15	The EWS should provide information on the risk related to breaching, inundation scenarios and should support the development of evacuation plans.	**1.0** **Fully implemented (inundation models and evacuation models are in place)**	**Relevant! Actualy it becomes a DSS. It is an addition to the EWS, but not really a part of it**	**Relevant. Can plans be tested on flexibility / robustness? May depend strongly on the location of breaching, that should be varied in the studies.**
16	An EWS platform should be open source.	**1.0** **The platform is open source, models can be proprietary**	**Relevant!**	**Useful to implement open source models as a fall-back option, even if these are more simple than proprietary models**
17	Specialized manufacturers should be able to produce specific modules (plug ins) of the EWS, whist the EWS platform protects the investments made by the manufacturers and buyers of the EWS.	**1.0** **This is possible**	**Relevant! The platform and some basic functionality should be open source. Proprietary plug ins possible**	**Still relevant, and in line with specifications 8 and 13 above**

No	Specification	Score and remarks	External Expert A	External Expert B
18	The platform should take care that plug-ins, that are not open source, should be replaceable with other plug-ins that have more or less the same functionality.	**1.0** **This is possible**	**Relevant!**	**Even with less functionality offering an open source alternative is useful, see at 16 above**
19	An EWS should be able to translate sensor data to information that can be used in the maintenance of dikes	**1.0** **This is possible**	**Relevant!**	**This is absolutely vital to successful implementation of an EWS in practice. If not used on a 'daily' basis, the system will either be forgotten or misunderstood in case of calamities**
20	Sensor data, and information that is derived from it, must be protected in order to prevent manipulation.	**0.5** **System can be hacked (as almost all systems even the CIA's))**	**Relevant!**	**The notion that any system can be hacked should not lead to irresponsible behaviour. A reasonable amount of protection should be applied.**
21	Data of EWS should be available for the scientific community in order to improve the knowledge of dikes and that of the performance of EWS itself.	**0.5** **Data is available, but there might be "political" objections**	**Relevant! We should decide the conditions for sharing data**	**Data is either available or not! It should be available, although a clause that results should be published only in anymity and/or with a certain time lag**
22	An EWS must have the built-in property to accommodate changing technologies and requirements.	**1.0** **This is possible**	**Relevant!**	**Relevant to adapt to the state of the art in future.**
23	Sensor systems use the internet to communicate data.	**1.0** **They do**	**Relevant!**	**Note that this cost-effective option also leads to vulnerability with regards to availability of communication and hacking the data**
24	The internet is the main medium through which the EWS interacts with the authorities and the public.	**1.0** **Yes**	**Relevant! This is not self-evident. You might e.g. decide to inform the public by SMS**	**Coherent with other specifications, note the assiociated drawbacks and the lack of having no alternative medium**
25	Multiple EWSs can run in parallel, allowing multiple objects to be monitored, or, as important, old and new versions of the EWS to coexist.	**1.0** **This is possible**	**Relevant! As long as the usability is not affected**	**Clear documentation of EWSs and versions thereof used is very important, also from a legal point of view. This also raises the point of justification of running older and newer versions at the same time.**
26	The EWS has a modular architecture that enables plug-ins as the CIS (common information space) and ones for artificial intelligence, decision support, scenario computations and visualization.	**1.0**	**Relevant! (see also 17)**	**Such an architecture is required to implement improved elements in the future and this is absolutely relevant.**
27	A single CIS technology should be used multiple times to implement all EWS functions and services, including the allocation of hardware resources, and the support of CIS services in the same manner as adopted by GEOSS and INSPIRE, as well as the management of EWSs.	**1.0** **This is implemented. GEOSS includes Inspire**	**Relevant! It must be robust and secure!**	**In line with other specfications**

No	Specification	Score and remarks	External Expert A	External Expert B
28	A complete EWS should be managed in a similar manner to a single plug-in (!), allowing the CIS technology also to manage complete EWSs.	1.0 This is possible	Relevant! This allows you to monitor the whole system	In line with other specifications
29	The CIS should manage the communication channels between the sensors and the EWS, e.g. to facilitate the process of adding new sensors.	1.0 This is possible	Relevant!	Relevant and in line with other specifications
30	Metadata should be available through the CIS / EWS services to ensure a proper interpretation of the data	1.0 This is possible	Relevant!	Required for proper interpretation of data
31	Enable other parties to locate the necessary entry points to the EWS to request the data.	1.0 This is possible	Relevant!	This should be done (not only be possible)
32	The data will be visualised for these authorities using the decision support tool included in the EWS. The decision support tool is an inter-active tool running on a Multi-Touch table.	1.0 This has been realized	Relevant! Not only at the Multi Touch table, also on Ipad, laptop ect.	The growth in touch-tablets could not be foreseen at the start of the project - is it easy to adapt to smaller-sized touchscreens? Multi-Touch tables aren't common.
33	Various versions of the EWS should be able to run in parallel allowing a smooth software upgrade strategy.	1.0 This is possible	Relevant!	In line with other specifications, see comment at no. 25
34	Multiple EWS should be able to monitor the same data, facilitating second opinions in the decision taking processes.	1.0 This is possible	Relevant!	Highly relevant and in line with several earlier specifications
35	An EWS must be created through an installer program (not by populating computer systems manually with software). This kick starts, technically and financially, the development of an EWS for the monitoring of another dike system or even a completely different environmental issue.	1.0 This is possible	Relevant! Seems easy and cheap	Relevant, but be aware of the contrast between general applicability and user-friendliness
36	A dedicated EWS must be created to (self) monitoring the UrbanFlood EWS, that is potentially running on several places on the internet, to create a robust EWS platform.	1.0 This has been realized	Relevant!	Relevant to create redundancy as a remedy against failure of communication
37	The CIS technology should facilitate the integration of other EWSs running on the same platform. This benefits, for instance, the modularity of complex EWSs as well as collaborations between several authorities each having a (part of) an EWS.	1.0 This has been realized	Relevant!	Relevant and in line with other specifications
38	Most, if not all software should run in a virtual computer / machine.	1.0 This has been realized	No opinion. For me too technical	Relevant as it reduces vulnerability
39	Virtual computers are organized with the UrbanFlood EWS framework software in a cloud.	1.0 This has been realized	No opinion. For me too technical	In line with other specifications
40	The CIS should manage the hardware resources needed by other plug-ins, resources are also obtained through the internet, distributing the EWS platform over multiple locations.	1.0 This has been realized	Relevant! As long as it does not become a black box	In line with other specifications, see e.g. no. 38.
41	CIS management technology only addresses rather abstract key performance parameters such as CPU time, storage capacity, memory in use and communication bandwidth. The management technology is otherwise unaware of what the components are doing. This should be the basis of the general purpose EWS hosting platform.	1.0 This has been realized	Relevant! No opinion. For me too technical	General applicability of the system dictates this.
42	The EWS should deploy state of the art mechanisms for robust and secure operations.	1.0 This has been realized	Relevant!	Relevant, cf. no. 20

No	Specification	Score and remarks	External Expert A	External Expert B
43	The system should monitor itself, the internet and sensor connections, and resource usage to warn and take real time counter measures for any technical failures and to acquire statistics about the availability of all components.	0.5 This has been realized partly (any = most)	Relevant!	Relevant and in line with other specifications. Failure to meet fully meet this requirement enhances the vulnerability of the total system, as pointed out before
44	Performance parameters of the EWS should be available for the EWS stakeholders.	0.75 (we need a list of typical performance parameters)	Relevant! You always should know (perhaps not the citizens)	Parameters should be available and understandable
45	Common design patters in securing and hardening enterprise service bus implementations can be and should be deployed.	1.0 This has been realized	Relevant!	Relevant and in line with other specifications
46	The origin of data and services should be traceable and logged.	0.5 We do not trace how the data is transported (so not everything)	Relevant!	Reliability of the data seems to be an issue in the UF EWS. It seems that m alicious replacement of the actual sensor data by dummy data would not be observed.
47	The plug-in and cloud services technology developed, should guard the IPR (and other commercial) issues of their owners.	1.0 This is supported	Relevant!	This specification seems to contradict others regarding open source. Commercial interests should be treated with caution, to ensure wide acceptance by stakeholders (which, in general, understand that services need to be paid for).
48	The EWS, and especially the CIS, will contain a web server and webservices technology that can support scientific and educational applications.	1.0 This has been realized	Relevant!	Relevant, and connected to the general availability of the data for the scientific community, cf. no. 21.
49	A single EWS must have enough observation capacity and must have sufficient qualities in terms of cost, maintainability en open-endedness	1.0 This has been realized	Relevant!	This specification has been formulated rather vague. On average, the UF EWS appears to have realized this, however
	Average score	0,94 >> 94% of the specified functionality has been realized The following extras have been realized: More dikes / objects online More models implemented System runs on more devices Prototypes for optimization		Impossible to trace that 94%, but the UF system has shown it is capable for its task. The realization of the extras as mentioned is a more or less logical result of that: if the system is attractive enough to the stakeholders, there is no need to wait implementing additional items until the EU project term has finished.

Annex 7 Intellectual property rights

In the following table the EWS modules and constituent parts are listed, and any restrictions to the use are outlined. For proprietary software, such as operating system components, models that are linked to the EWS and possibly proprietary software for the visualization of model results the license rights are with the license holder, and (prospective) users need to purchase a license. But because the EWS structure is open it is possible to use 'own' models within the EWS, models for which the user already has the license or models which are open source. All software and modules that are developed as part of the project efforts are available free of charge at: urbanflood.cyfronet.pl and www.urbanflood.eu from the homepage.

Module	**IPR status**	**License holder**
AI Anomaly detection	Proprietary	Siemens
AnySenseMessagesGenerator (ASMG)	Free with restriction	Siemens
RELIABLE	Freeware	HR Wallingford
Hydrograph	Proprietary	HR Wallingford
HR BREACH	Proprietary	HR Wallingford
Flood Simulator (Dynamic RFSM)	Proprietary	HR Wallingford
City Evacuation / Life Safety Model (LSM)	Proprietary	HR Wallingford
Virtual Dike	Proprietary	University of Amsterdam
Visualization services for interactive exploration of Inundation simulation results	Free with restrictions	University of Amsterdam
Visualization services for interactive exploration of City Evacuation simulation results	Free with restrictions	University of Amsterdam
Inundation job submission services	Free with restrictions	University of Amsterdam
Anysense	Free with restrictions	TNO
Multi-Touch interface	Free with restrictions	TNO
Multi-Touch Demo	Free with restrictions	TNO
SiteManager	Free with restrictions	Siemens (20% owned by Siemens)
XenStore config scripts (Win+Lin)	Free with restrictions	Siemens (100%)
DataProxy for demo	Free with restrictions	Siemens (100%)
SensoFusion	Free with restrictions	Siemens (100%)
CIS: PlatIn	Open Source	Cyfronet
CIS: DyReAlla	Open Source	Cyfronet
CIS UfoReg,	Open Source	Cyfronet
CIS: ErlMon	Open Source	Cyfronet
CIS: Scribe provenance repository	Open Source	Cyfronet
CIS: QUaTRO provenance browser	Open Source	Cyfronet
Flood EW: Flood Simulation Part,	Open Source	Cyfronet
Flood EW: Dike Reliability Part	Open Source	Cyfronet

Dike Anomaly Analysis Part	Open Source	Cyfronet
Flood EW: Life Safety Part	Open Source	Cyfronet
Flood EW: Virtual Dike Part	Open Source	Cyfronet
Flood EW: Attention Level Manager Part	Open Source	Cyfronet
Flood EW: Archiver Part	Open Source	Cyfronet

O=Open Source, free; P=Proprietary; R=free with restrictions)

Table 3: IPR for UrbanFlood EWS components

The project partners grant each partner the right to use proprietary software which is part of the present UrbanFlood EWS after the end of the project, in order to support their exploitation efforts, under license from the license holder specified in Table 3. This right is already explicitly granted under the Consortium Agreement (for the relevant text, see **Error! Reference source not found.Error! Reference source not found.**).

Annex 8 Cost estimation of UrbanFlood

This annex gives an indication of the costs related to dike monitoring compared to dike reinforcement. The estimates for the monitoring are made based on UrbanFlood test locations and Livedike projects from the IJkdijk Foundation. The estimates for reinforcement were derived from the new "Hoogwaterbeschermingsplan" (High Water Protection Plan). The costs in te column "Per Event" are related to costs that have to be made when a dike is in danger of breaching

Type	Per location	Per Meter	Per Event
UrbanFlood			
Sensor installation	50,000/location	200 €/m	10,000€
Cloud servers for ringdike/rhinedike/boston types of installation	2,000 €/year per private cloud permanent use[8]	0.4 €/ m	240 €/event Private analysis EWS for use on demand[9]
Tuning of models	5,000 €/dike slice	-	10,000 €/event
Configuration / Activation of EWSs	5,000 €/EWS	-	5,000 €/event
Dike Reinforcement			
Dike design	1,000,000 €		
Dike creation		6,000 €/m	
Dike improvement		6,000 €/m	100,000 €

From these figures it is obvious that the costs of monitoring is only a fraction of the costs of a reinforcement project.

[8] http://www.hetzner.de/hosting/produktmatrix/rootserver-produktmatrix-ex/

[9] http://aws.amazon.com/ec2/pricing/

Annex 9 Assessment of Deliverable 7.9

Relevance	showing the extent to which the deliverable contributes to the UrbanFlood goal ***D7.9 contains the evaluation of UrbanFlood as is required by the DOW***
Efficiency	showing the amount of MM and resources spent in relation to the planned results. ***D7.9 was estimated in the DOW to cost 3 PM's. Eventually it has cost approximately 2PM's (the issue is that we report on WP's and not on deliverables)***
Effectiveness	showing the extent to which the objectives were achieved, or are expected to be achieved, and related to the WP task list, deliverable and milestone list ***The objective of D7.9 was to evaluate the impact of UrbanFlood (this document). D7.9 relates to task 7.7 in the DOW "Impact Analysis" and Chapter B3 of the DOW "Potential Impact".***
Impacts	being a qualified description in how far the deliverable progresses the UrbanFlood project to its goal. ***D7.9 is one of the required deliverables. It contributes to objective 1 and 5.***
Sustainability	being a list of efforts for the continuation of the results described in the deliverable in the forthcoming years, after the UrbanFlood task is completed. ***See paragraph 2.5 of this document, describing the potential and plans for exploitation of the results by the partners***
Coherence	description of the relevance of the deliverable for external stakeholders ***See paragraph 2.6 of this document, describing the suitability of the system***
Quality	where appropriate a list of descriptions, performance tests, requirement checks, interworking tests, model cross validations, publications, interviews, expert opinions, experimental outcomes ***Interviews and expert opinions are described in paragraph 2.6 of this document***

Annex 10 User feedback

In this annex the results of demonstrations during the FloodRisk 2012 Conference in Rotterdam (21 and 22 November 2012 are summarized. People who followed the demonstration were asked to fill out a short questionnaire. The ratings are depicted In the following table and summarized in the figure below it. After that follow the open questions and the answers given to them. In total 24 questionnaires were filled out. An average of 80% of the respondents scored 5 or 4 to the first 4 questions. The usability scored somewhat lower (70%) and the UF demo somewhat higher (90%).

Subject to evaluate / Rating ***(5 – Excellent, 1 - very poor)***	**5**	**4**	**3**	**2**	**1**
How would you rate the overall usability of the UrbanFlood EWS?	111 111 1	111 111 111 1	111 111 1		
How would you rate the multi-touch screen on ease of use?	111 111 111	111 111 111	111 11	1	
How would you rate the on screen demo of the UrbanFlood EWS?	111 111 111	111 111 111 111 1	11		
How would you rate the ease of extracting the technical data from the multi-touch screen? None: 111	111 111 1	111 111 111 1	111 1		

Results qustionnaire								
	5	**4**	**3**	**2**	**1**	**Total**	**5+4**	**%**
Usability EWS	7	10	7			24	17	71%
Ease of use MTT	9	9	5	1		24	18	75%
UF Demo	9	13	2			24	22	92%
Extracting Technical data	7	10	4			21	17	81%
								80%

Answers to the open questions

Do you think the UrbanFlood EWS provides all the data and information your business would need from an EWS?

- *No 2x*
- *I am afraid I am not the target business*
- *Almost*
- *In principle: yes*
- *Not yet, but that is a matter of time (development)*
- *Not that much*
- *Yes*
- *Depends on the propose: for a day to day use for waterboards yes, for R&D use perhaps less*
- *No, base data about the subsoil (CPT's, boorholes, 3D soil models) is needed too*
- *It provides a good number of data from local sensors but would be great to included remote sensor data*
- *Yes, I assume more could be included, such as weather forecasts, tide forecasts*
- *It's a very good start*
- *A very useful addition perhaps in support of existing methods whiles concepts is being proofed*
- *Yes, for this purpose*
- *Suggestion: open the app and data for the general public*
- *There is always room for more data, but this looks like a good start. Would be best to keep it modular /open source though*
- *Not yet, bugs*
- *No, but could be*
- *Probably additional modules need to be implemented to process different types of input data ((SP meadures/EM/..)*
- *First good step, more parameters needed*
- *Depends on the purpose*
- *N/A*

Do you envisage your business using the UrbanFlood EWS? What improvements would you like to see?

- *Different layers for end-users*
- *Yes, incorporate with FEWS keringen*
- *Simplify, reduce the number of actions/clicks*
- *I would be interested in adding more data about hydraulic structures such as weirs, sluices, barriers*
- *Very possible. Could it be flood forecasting systems*
- *No 2x*
- *We're more involved in research data*
- *Increase verifications and standardisation*
- *Yes 4x*
- *We will need this kind of technology in the future. The link between monitoring and physical condition / performance needs improving*
- *Possible would need to know more*

- *Addition of more sites*
- *I imagine to use the underlying data/ techniques*
- *Most likely. Improvement would be sub-surface model. I.e. build up of soil until Pleistocene*
- *Stability system*
- *More special plans*
- *No, we're a consultancy firm*
- *Possibly in future, include insurance option and risk curves at estate level*
- *Not really in its current form, as a social scientist researcher I can see the use of the system for communicating exchanging knowledge, but does the system permit the easy capturing of information i.e. from local experts, can you save drawings on screen for instance?*

What do you perceive are the barriers to your business taking up the UrbanFlood EWS?

- *How to relate the measurements to a good prediction of future?*
- *Technical, business interest?*
- *Costs?*
- *N/A (I am academic)*
- *How is it made available? Costs?*
- *Combine with own business intelligence (IP)*
- *Need frequency predict flood*
- *We are not water / flood management agency*
- *It must be linked to the process of customers*
- *Internet or electricity break down during flood incident*
- *Data uploading and format*
- *Need examples of use over larger periods*
- *Costs*
- *Fear of 'black box' is it calibrated?*
- *Satisfaction of the benefits to different user groups*
- *Open integration with additional platforms*
- *Mostly cost and executive issues*
- *Stability system*
- *Finances*
- *We're a consultancy firm*
- *Accuracy reliability*
- *Obviously business case what is there to gain not yet complete*
- *N/A*

Do you think there are any other groups and organisations that may benefit from the UrbanFlood EWS?

- *Yes, waterbaoards, inhabitants of dike rings*
- *Will think about it*
- *universities*
- *river model developers and users*
- *local and regional barrier managers of policy makers (if not already included)*
- *Any flood defiance manager*

- *Yes, multiple geo hazard management applicants*
- *Yes 2x*
- *Waterboards, province, municipalities*
- *Educationals purposes (high schools, etc)*
- *US level managers*
- *Reservoir managers*
- *Different ride management authorities, reservoir owners, road, soil etc*
- *General publics*
- *Waterboards, if stable, IJkdike, Flood Control*
- *Yes, flemisch government: Flandero Hydraulics Research, NV de scheepvaart, Waterwegen en Zeekanalen*
- *Waterboards,, Ministeries*
- *The system has great potential to be adopted in a number of situations, however for that cost / awareness of the technology would be barriers*

Any other comments?

- *Looks very nice*
- *Table looks great! Keep on adding functionalities*
- *Very nice / attractive solution!*
- *Looks very nice*
- *Good job and hope to see grow / increase in number of sites added*
- *Very exciting and visual product that is of great potential value to decision makers in an emergency*
- *Very intuitive, an exciting tool!*
- *Thanks for the demo!*
- *Appreciate to stay informed*
- *You might have scenarios ready for demonstration of the benefits.*
- *Easy for non-specialists to use, although did not necessary understand all of the technical information*
- *I think that the application of the screen + information have some needing further developments + might be need in all situations for engaging the public about their flood risk. Have you also formally renovated the ease of use of the touch screen + the information presented within the UrbanFlood e.g. through asking users to find / access/ + use specific information => or set up a scenario for them to complete.*

Annex 11 Intentions of Non-UrbanFlood partners

This annex contains a number of "Letters of Intent" from non-UrbanFlood partners to continue cooperation with one or more of the UrbanFlood partners after the formal ending of the project.

From: Michael Mooney [mailto:mmooney@mines.edu]
Sent: woensdag 5 december 2012 13:28
To: Meijer, R.J. (Robert)
Cc: Pals, N. (Nico)
Subject: RE: Review UrbanFlood

Dear Robert and Nico,

We will be very happy to continue to collaborate with you over the next 4 years through our new project funded by our National Science Foundation. The work that Urban Flood has accomplished is terrific, and we very much plan to pick up the ball and continue to move it forward. We can do this best through collaboration with you.

Best regards, Mike

Michael A. Mooney, Ph.D., P.E.
Professor and Director of SmartGeo
Acting Director of Center for Underground Construction & Tunneling
Brown Hall, Room 280G Colorado School of Mines
Office: (303) 384-2498 Mobile: (303) 881-7200
control.mines.edu/mooney
http://smartgeo.mines.edu
http://uct.mines.edu

From: Roelof Versteeg [mailto:roelof.versteeg@subsurfaceinsights.com]
Sent: woensdag 5 december 2012 18:11
To: Meijer, R.J. (Robert)
Cc: Pals, N. (Nico)
Subject: RE: Review UrbanFlood

Hi Rob en Nico

I am strongly committed to push the collaboration forward and find new opportunities in the future. As an aside, I am at the AGU this week and will send you some thoughts early next week as to developments there which may be of interest to you.

Cheers

Roelof

From: Abdoun, Tarek H [mailto:abdout@rpi.edu]
Sent: woensdag 5 december 2012 12:24
To: Meijer, R.J. (Robert)
Subject: RE: Review UrbanFlood

Hi Robert,

As I have mentioned many times before I hope our working relation would continue after the Urbanflood ends. What the Urbanflood team developed has important value and should be maintained/expanded beyond the project timeline.

I look forward to working with you on the Thailand project. I'll be there next week and I'll be talking about our USA effort as well as Urbanflood.

Best regards,

Tarek

From: Andrew Tagg [mailto:A.Tagg@hrwallingford.com]
Sent: vrijdag 30 november 2012 16:48
To: Bob Pengel (bob.pengel@gmail.com); Pals, N. (Nico); Meijer, R.J. (Robert)
Subject: Use of UF video

Dear All

I have done a Skype interview today with 'Weather online' from the USA, which included discussion of the UrbanFlood project. They are looking at how laboratory research can produce useful outputs for people to use in the real world to combat flooding. They want some more footage from us of the type of research we do in our labs, but I was wondering if you would be happy if I supplied them with the UF video, that they could then use as they see fit. Is this possible/desirable?

Thanks

Andy

Andrew Tagg
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From: Robinson, Mark [mailto:mark.a.robinson@environment-agency.gov.uk]
Sent: Friday, May 25, 2012 3:09 PM
To: Jonathan Simm
Cc: Campbell, Duncan; Mitchell, Gemma; 'nick.rowlinson@environment-agency.gov.uk'; Alexandra Topple; Tim Chesher; Mike Dearnaley
Subject: RE: UrbanFlood and Boston Barrier

Hi Jonathan

Following internal discussions, there is an appetite for the monitoring to continue beyond 2012 and post barrier, subject to the final agreement.

I hope you are able to accept this as an 'in principle' decision.

Speak soon.

Regards

M**ark Robinson**

Coastal Advisor
Anglian Region, Northern Area

(**Telephone : 01522 785325**
(**Internal : 7 50 5325**
(**Mobile : 07769 932038**

* **Post : Environment Agency, Guy Gibson Hall, Manby Park, Louth, Lincs, LN11 8UR**
* **E-mail : mark.a.robinson@environment-agency.gov.uk**

Annex 12 Business potential

This annex contains some emails from SME's with their estimation of the business potential of dike monitoring.

From: Wouter Zomer (wouter.zomer@bzim.nl) [mailto:wouter.zomer@bzim.nl]
Sent: donderdag 6 december 2012 15:25
To: Pals, N. (Nico)
Subject: Re: Question about the business potential of dike monitoring .....
Importance: High

Dijkmonitoring, zo besloten we ooit in een business case van stichting IJkdijk, mag ongeveer 5 tot 10% van de versterkingskosten bepalen. Kanttekening is dat we alleen naar versterkingen keken. Gemiddeld kost een versterking ongeveer 9 miljoen euro. Beheerders blijken echter niet voornemens om 4,5 tot 9 ton te investeren in monitoring en ik denk ook niet dat dit een goede inschatting is. Zelf denk ik dat je, afhankelijk van het doel van monitoring het volgende lijstje kunt aanhouden:

- Toets op veiligheid (zoals deze nu op statische wijze wordt uitgevoerd en dat vind ik zelf niet de beste manier): 50.000 per kilometer. Indien dynamisch uitgevoerd rond 150.000 per kilometer.
- B&O: 100.000 – 150.000 per kilometer
- Calamiteiten/early warning: 150.000 – 500.000 per kilometer (afhankelijk van de locatie van de calamiteit)
- Versterkingsoptimalisatie: 150.000 – 300.000 per kilometer, waarbij bedacht moet worden dat die dijken gemonitord worden die er ook daadwerkelijk baat bij hebben.

Je verwacht er mee te bereiken:

- Kostenreductie door minder dijken af te keuren
- Optimalisatie beheer en onderhoud
- Optimalisatie versterkingsontwerp
- Calamiteitenzorg: risicobeheersing

Markt omvang in Nederland: ooit geschat op 20 miljoen per jaar. Wereld wijd geschat op 500 tot 1.500 miljoen per jaar.

Eea opgesteld obv ervaring, goede marktverkenning en omdat er sneeuw ligt vandaag (dat wil zeggen: redelijk arbitrair).

Kun je hier wat mee?