



FLASH FLOODS
AND PLUVIAL
FLOODING



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Working Group F Thematic Workshop

Pluvial Flooding In Europe

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European Water Association Technical and Scientific Committee

26th-28th May 2010, Cagliari, Italy



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Overview

- Outcomes from the **EWA Expert Meeting** on Pluvial Flooding
- Current **UK Practice** and Guidance
- Synergies with the **FloodResilienCity** project
- **Questionnaire Responses from FloodResilienCity** project partners
- Summary of **Discussion Points**



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EWA Expert Meeting on Pluvial Flooding

28 October 2009, Brussels

Attendance

- Member State representation and invited experts involved in pluvial flooding and urban flood management
- Italy, Hungary, Poland, Netherlands, Ireland, Portugal, Spain, UK, Commission, JRC and EWA
- Draft report circulated to Interested MS including France Germany and Sweden



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EWA Expert Meeting on Pluvial Flooding

28 October 2009, Brussels

Aims

- To take stock of the **importance and relevance of pluvial floods across Europe** and identify issues that can be further developed at the thematic workshop on Flash Floods and Pluvial Flooding
- Prepare a **'situation paper'** to inform further consideration of pluvial flooding in Europe.



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Topics Considered

- **Characteristics** of pluvial flooding and understanding of relevant processes
- Identifying the problem: **extent of pluvial flood risks** across Europe – implications of **climate change**
- Approaches to **mapping and risk assessment**
- Potential **mitigation measures**
- Review of **current research** (Imprints, FloodResilienCity, Tisza Basin) - aspects requiring guidance and further research



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Characteristics of Pluvial Flooding

Pluvial Flooding is flooding as a result of **heavy rainfall** when water which does not infiltrate the ground **ponds** in natural or artificial hollows or **flows** over the ground as overland flow, **before** it enters a natural or man-made drainage system or watercourse or when it cannot enter because the system is already full to capacity.



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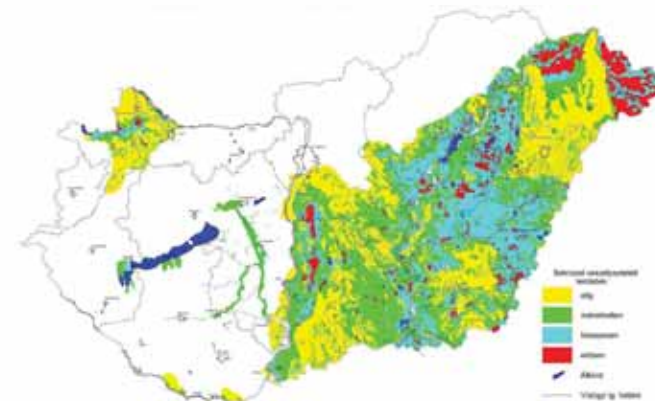
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Characteristics of Pluvial Flooding

Usually associated with **short duration high intensity** rainfall but can also occur with lower intensity rainfall over longer periods, or melting snow, and can be worse when the ground is saturated, frozen, compacted, developed or otherwise has low permeability.

High velocity overland flow and deep ponding and pose a particular hazard.

Pluvial Flooding is in some countries referred to as **Excess Water Flooding**



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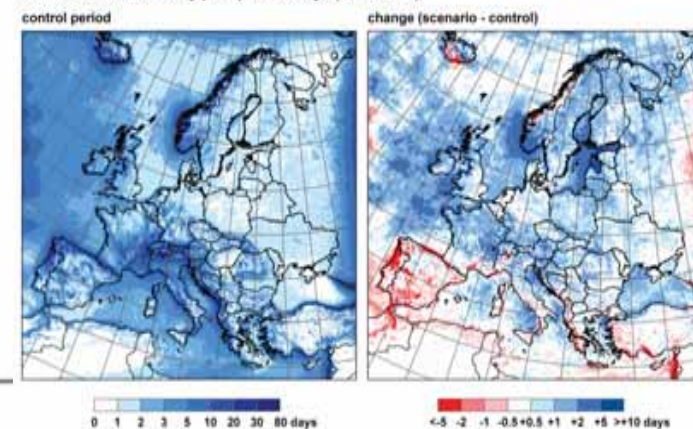
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Extent of Pluvial Flood Risk across Europe

- “Pluvial flooding can **happen anywhere at any time**”
- **Climate change** likely to make worse. Land-use also a factor.
- Greater vulnerability in **urban areas**?
- Is there a greater risk in **western, northern and central Europe**? but areas of increased risk elsewhere also.
- **Questionnaire** to determine extent of problem across Member States
 - do differences in **organisational responsibilities** affect understanding of the problem?
 - level of **vulnerability**?

Annual number of heavy precipitation days (P > 20 mm)





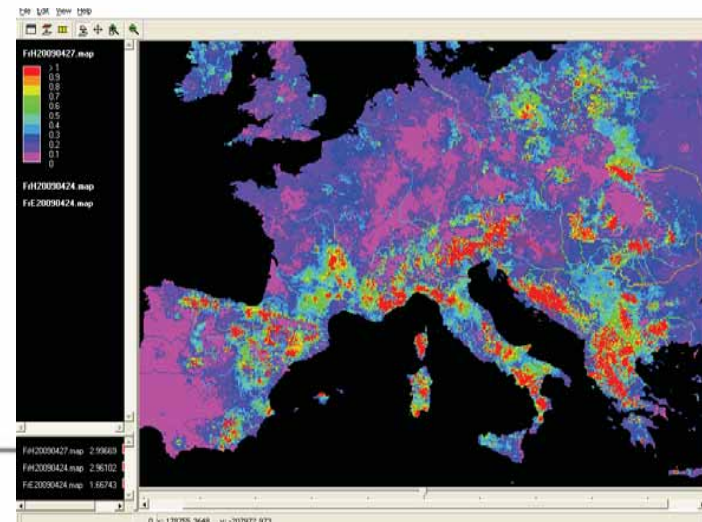
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Approaches to Mapping and Risk Assessment

- **Evidence base** will be required to demonstrate assessed level of **significance**.
- **Observed incidents** of pluvial flooding very valuable – use as much as possible. Can be masked by other types of flooding.
- Top down **risk based approach** with progressively more detailed assessment where justified. Site inspections valuable.
- Fixed methodologies should not be imposed on Member States – provide **good practice examples**.
- **Methodologies evolving rapidly** - provide examples of application.





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Potential Mitigation Measures

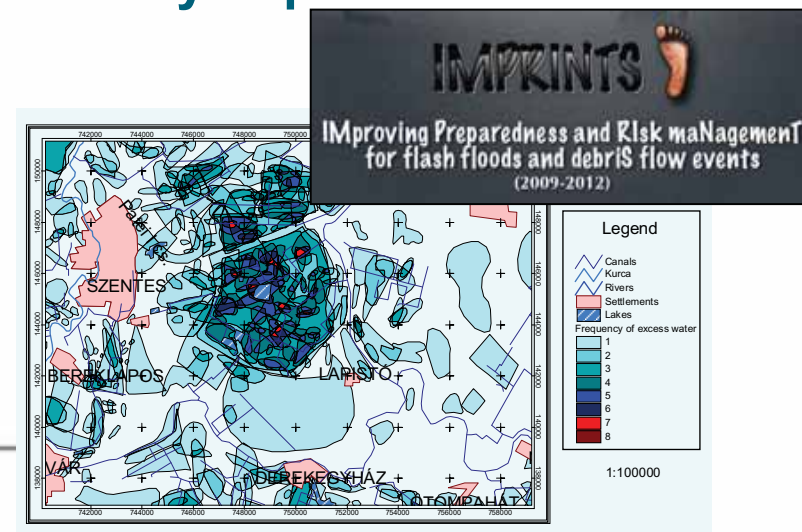
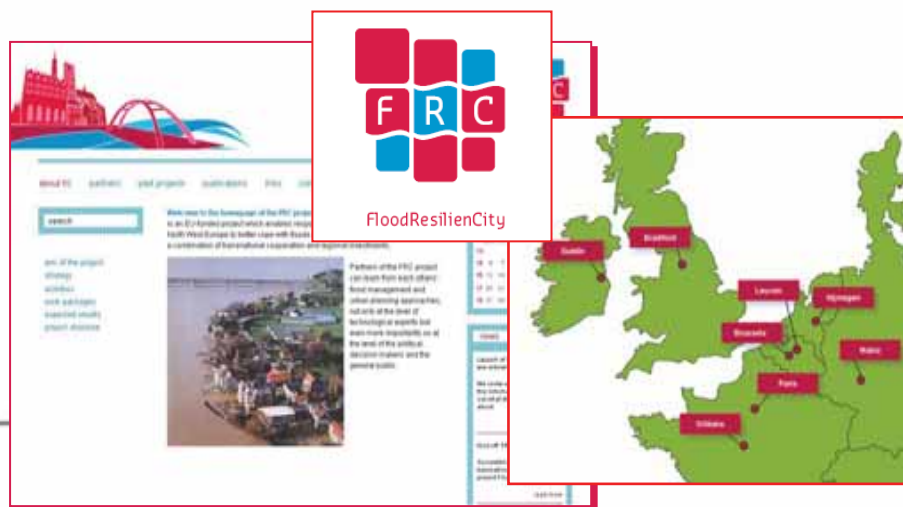
- Solutions likely to comprise of a **mix of measures**:
 - **source control** and **overland flow routing/storage**
 - **improved conveyance** (larger sewers, drains and urban channels)
 - **resistance, resilience** and **non-structural** measures
- **Adaptable** solutions – climate change uncertainty.
- Gather examples to prepare a **catalogue of good practice** and **win-win measures**. Catalogue existing guidance documentation.
- Include examples of good **planning control** – national legislation could assist.
- **Public education** is important – source control measures.





Research Initiatives

- **Categorisation of 'magnitudes' of flooding** rather than specific flood probabilities – also categorisation of sources of flooding.
- **Harmonising land use** and rural development.
- Need for **awareness raising** about pluvial flood problems.
- Some extensive records of past flooding (for example Excess Water Flooding in Hungary) – **data collection of key importance.**





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EWA Expert Meeting Way Forward

- **Questionnaire** to determine extent of the problem.
- Develop key issues at **Cagliari Workshop**.
- Identify needs for **further guidance and research**.





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Current UK Practice and Guidance



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Glasgow: August 2002



Shettleston Pluvial Flood Aug 2002
Images courtesy Scottish Water



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Hull and Sheffield: Summer 2007



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London area and Berkshire: July 2007



Images courtesy BBC News Website

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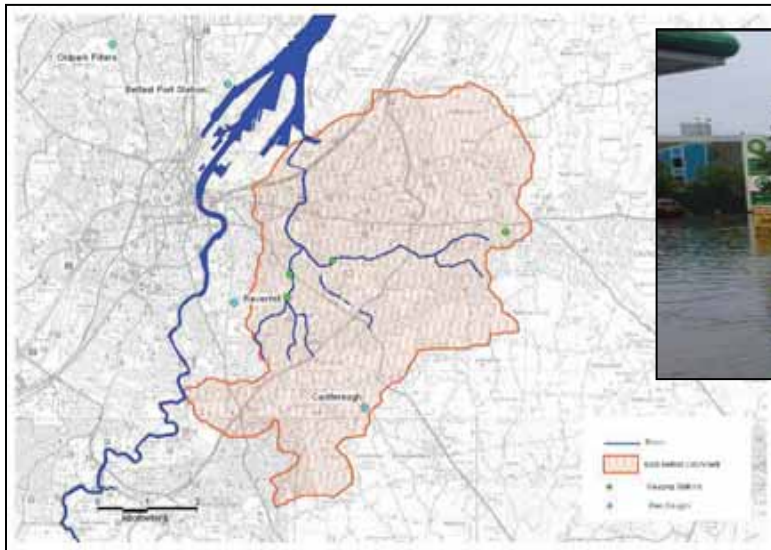
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East Belfast: June 2007

98.3mm of rain fell in 1 hour in the East and South Belfast catchments.

Resulted in both fluvial flash flooding and pluvial flooding which caused major disruption with over 400 properties affected.





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Climate Change



- Higher energy storm events with near **'tropical' rainfall intensities** producing 'pluvial' surface water flooding and flash floods.
- Annual precipitation could increase **more than 40%** in some parts of northern Europe by 2100 – **30% increase** in peak rainfall intensity possibly.
- Potentially **>100% increase in properties affected** and 2 - 20 times increase in flood damage



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SEPA Study Improved Understanding of Pluvial Flood Risk in Scotland



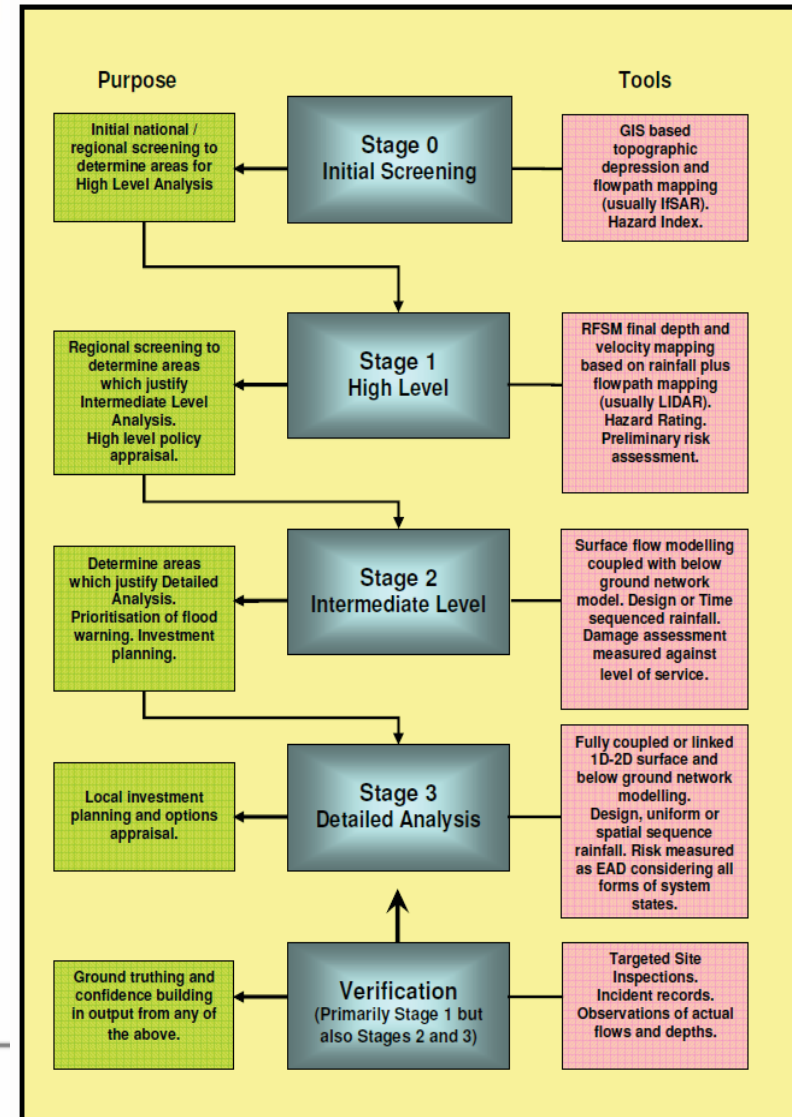
- Collection of flood hazard information on **past pluvial flood events** in Scotland.
- Review of the **processes** involved in pluvial flooding.
- Development of **screening tool** to identify pluvial flood susceptibility.
- Application of the screening tool – **Edinburgh** used as **pilot** study area.
- Production of **technical guidance** for further, more detailed pluvial modelling.

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SEPA Technical Guidance: Staged approach

- Level of assessment should be **proportionate** to perceived level of pluvial flood risk.
- Commence with **screening** - then target **progressively more refined modelling** and assessment at the areas of greatest assessed risk.
- **Best value** from available budget and resourcing.





Richmond and Kingston First Edition SWMP

“a framework through which key local partners ... work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk”.

Key SWMP Elements

- Preparation
- Risk assessment
-**Staged Approach**
- Options appraisal
- Implementation & review





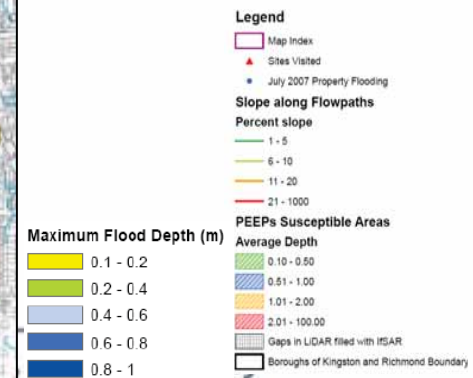
Screening Tools and Mapping

'Dry' method:

- GIS based **Contour Polygon Screening** – simple high level determination of ponding depressions.
- GIS Based 'rolling ball' **Flowpath Generation** – bare earth DEM with buildings superimposed.

'Wet' method:

- Rainfall generation based on FEH – total rainfall depth for given probability and duration.
- Final depth calculation.





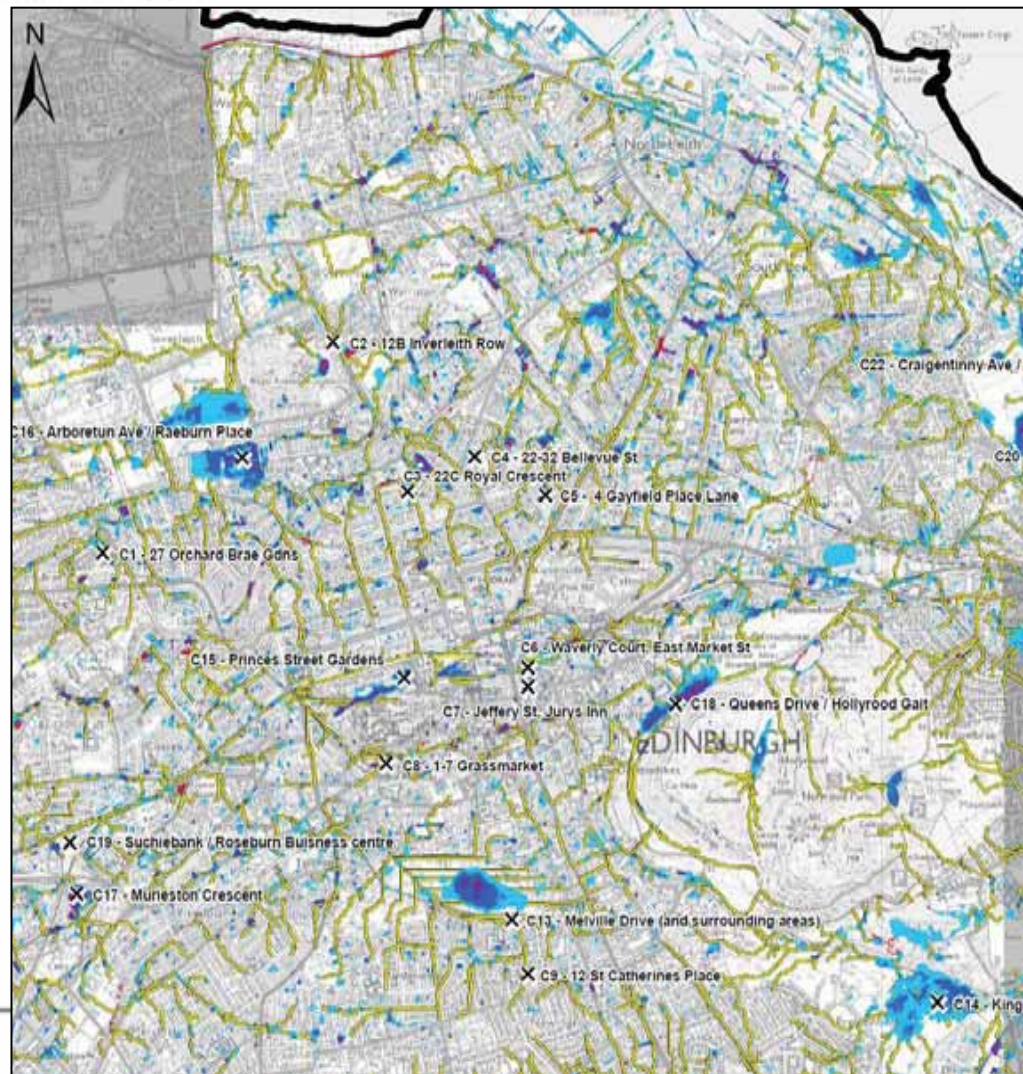
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Screening and Mapping: Ponding Areas and Flowpaths Edinburgh Central and Leith 1:200 3hr rainfall event

- X Site Visit Locations
- Final Depths, 1:200 3hr (m)
 - 0.0 - 0.1
 - 0.1 - 0.5
 - 0.5 - 1
 - 1.0 - 2.0
 - 2.0 - 10
- LiDAR Flowpaths
 - Bare earth + buildings
 - No LiDAR CPS Processing





Site inspections for preliminary risk assessment:

- 49 locations in Richmond and Kingston visited over 4 days
- simple **scoring system** to rate perceived **overall risk**

Attribute	Hazard Level	Very Low	Low	Moderate	High	Very High
Depth of Flooding	Description	<0.2m	0.2m to 0.5m	0.5m to 1m	1m to 2m	>2m
	Score	0	1	2	3	4
Extent of Flooded Area and Properties at Risk	Description	Localised <0.1ha No properties potentially at risk	Localised <0.1ha 1 property potentially at risk	Moderate (up to 1ha) Up to 10 properties potentially at risk	Extensive (up to 10ha) Up to 100 properties potentially at risk	Widespread (>10ha) More than 100 properties potentially at risk.
	Score	0	0	1	2	3
Flowpath feeds topographic depression ?	Description	No or Flowpath only.	Yes. Depth <0.5m	Yes. Depth 0.5-1m	Yes. Depth 1-2m	Yes. Depth >2m
	Score	0	0	1	2	3
Velocity of Flow	Description	Still Water (generally flat terrain). Any depth.	Velocity up to 0.5m/s (generally gently sloping terrain) and Depth less than 0.5m.	Velocity 0.5 - 1m/s (generally moderately sloping terrain) and Depth less than 0.5m.	Velocity more than 1m/s (generally steeply sloping terrain) and Depth less than 0.5m.	Velocity more than 1m/s (generally steeply sloping terrain) and Depth more than 0.5m.
	Score	0	1	2	3	4
Sensitivity of Land Use	Description	Open areas that can be flooded without significant consequence.	Parkland, open ground or farmland where flooding would have some consequence.	Suburban residential / commercial / retail / industrial areas where flooding would have moderate consequence.	Central urban or town centre residential / commercial / retail / industrial areas where flooding would have high consequence.	Critical infrastructure present. Critical transportation links present. Basement flats present.
	Score	0	1	2	3	4
Doorway Threshold Levels	Description	Most above 0.2m above ground level	Most above 0.2m but some 0m to 0.2m above ground level	Most 0m to 0.2m above ground level	Most at ground level. Some below ground level.	Most below ground level
	Score	0	1	2	3	4
Total Score		0 to 2	3 to 4	5 to 7	8 to 10	>10
Overall Preliminary Risk Rating		Not Significant	Low	Moderate	High	Severe



Preliminary Risk Assessment – Richmond and Kingston

- Summary **results of site inspections**:
 - table shows results as percentage of **sites visited**, not land area.

	Low or Insignificant Risk	Moderate Risk	High Risk	Severe Risk	Potential Risk to Life
Points Score	0 - 4	5 - 7	8 - 10	> 10	-
Richmond (20)	25%	50%	20%	5%	10%
Kingston (29)	24%	41%	28%	7%	14%



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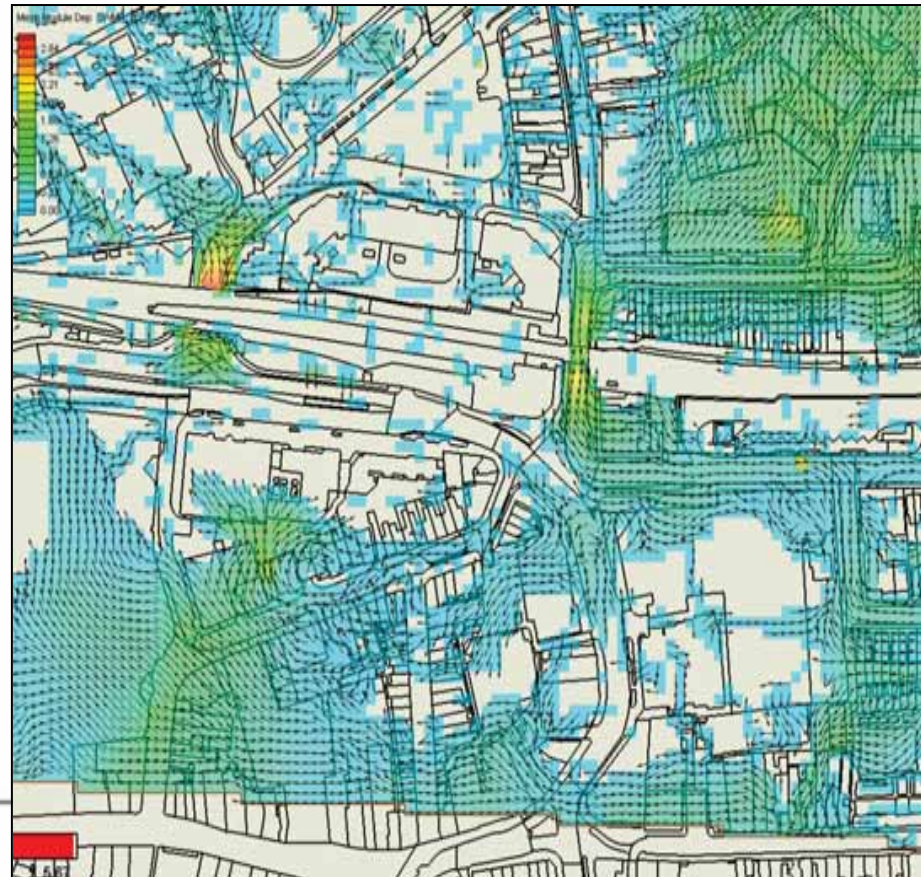
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Detailed Risk Assessment – Critical Areas

- **2D hydraulic model** (TuFLOW) of specific locations, built using DEM with buildings 'stamped' on
- Determine rainfall input for **various scenarios** (e.g. 4.5hr duration event with a 1:200 chance of occurring)
- Assume **proportion of rainfall removed by underground systems** (information provided by Thames Water)
- Model **depths and velocities** of excess water at the surface





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Acre Road to Petersham

Maximum depths and
velocities

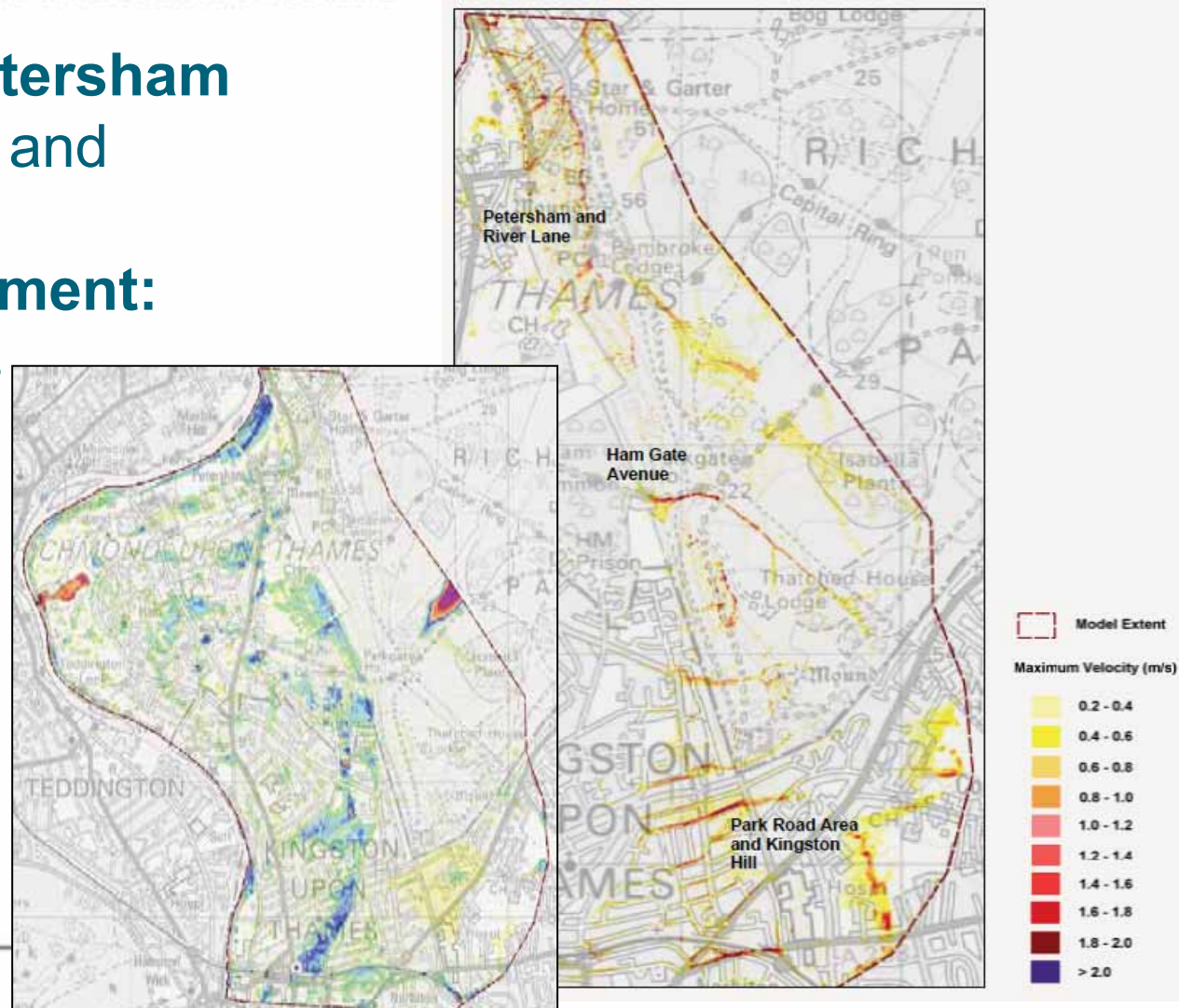
Damage Assessment:

12,400 properties

Annual Average

Damages

3m Euro





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Options Evaluation

- **Do nothing:** no maintenance, increasing risk
- **Do minimum:** ongoing maintenance, deterioration with climate change
- **Source control and SUDS:** reduce rate/volume of runoff through infiltration and storage
- **Design for exceedance:** control passage of some retained surface water through the urban environment
- **Increasing capacity:** add storage and/or capacity to underground sewers and drains
- **Separation of foul and surface water:** alongside effective surface water management, this can reduce flooding and pollution
- **Non-structural measures:** influencing behaviour, e.g. maintenance, warning, land management, building resistance and resilience measures.





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Richmond and Kingston SWMP Outcomes

- **Screening** – hybrid approach using **composite** of wet and dry techniques – overlay flowpaths.
- Value of **Site Inspections** preceded by **desktop review** – verification / source of flooding / land use / preliminary risk assessment / mitigation measures.
- **Preliminary Risk Assessment** based on site inspections - convenient, easily applied and rapid method of assessing potential severity of surface water flood risk.
- **Option Evaluation Matrix** coupled with **Stakeholder Workshop** – MCA scoring approach to identify most appropriate options.





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Practical Outcomes

Basement Flats

- Basement flats may be particularly vulnerable and pose a significant **risk to life** where adjacent to flowpaths or within a topographic depression. Carefully assess risks and mitigation.



Underground Access

- Similarly for access points to underground car parks or basement areas where there could be a possibility of **rapid inundation** and restricted safe exit. Access points to low level or **underground stations** may also be vulnerable. Simple measures may include **raised ramping** across entrances.





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Schools (and Public Access Establishments)

- Appear to be **particularly susceptible** – high number of reported incidents at schools.
- Particular attention to those where **topography flat** or in ponding areas.

Doorway Threshold Levels

- Doorway thresholds relative to street or ground level a **critical factor** in determining the impact of surface water flooding.
- Many high street **Retail Premises / Shopping Centres** have **street level doorway thresholds** and even shallow surface water flooding could cause extensive damage and disruption.
- **Bow-wave** from any passing traffic may also compound the problem.





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Transport Infrastructure

- Deep ponding can be associated with railway and road infrastructure either due to a **damming effect** where embankments intersect surface water flowpaths or at **underpasses**. Particular attention should be given to disused rail or road embankments.



Flood Emergency Planning

- Flood emergency planning should ensure that **safe evacuation routes** are not compromised by locations where significant surface water flood hazard is identified – high velocities or deep ponding.
- **Pre-emptive planning** to take susceptible areas into account.
- Couple with **Extreme Rainfall Alerts**





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Synergies with the FloodResilienCity Project

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FRC Work Packages - Dublin

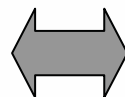
- **Awareness** - Flood Damage Predictive Models (Integrated Flood Forecasting System and 3D Urban Exceedance Model)
- **Awareness** - Flood Awareness and Response Framework (Flood Partnerships Framework Plan)
- **Avoidance** - FRM and Spatial Planning (Spatial Planning and Flood Resilience Regulations)
- **Alleviation** - 'Streets as Streams : Roads as Rivers'
- **Assistance** - Flood Information Management System



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**FRC Programme Elements
Relevant to Pluvial Flooding**



**Emerging UK SWMP
and Pluvial Flooding Practice**



Awareness

- 1D / 2D flood modelling and integrated mapping ↔ **Risk Assessment** - staged approach /future scenarios
- Integrated flood forecasting and warning ↔ **Implementation** - action plan
- 3D urban exceedance model ↔ **Risk Assessment** - map and communicate risk
- Flood partnerships framework and flood ↔ **Preparation** - establish SWMP partnership
- awareness and information ↔ **Options** - social change, education and awareness

Avoidance

- Spatial planning and flood resilience ↔ **Options** - planning policies / improved resilience
- Water sensitive urban design ↔ **Options** - source control, SUDS, storage etc

Alleviation

- 'Streets as Streams and Roads as Rivers' ↔ **Options** - overland flow management, maintenance
- Flood alleviation (FA) techniques in urban areas ↔ **Options** - temporary defences, SUDS, etc
- FA by structural and non-structural means ↔ **Options** - weather warning / improved resilience etc

Assistance

- Civil flood assistance plan ↔ **Implementation** - action plan
- Flood information management system ↔ **Risk Assessment** - map and communicate risk
- Flood resilience in the community ↔ **Risk Assessment** - map and communicate risk
- Flood response management ↔ **Risk Assessment** - map and communicate risk



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Questionnaire Responses from FloodResilienCity project partners

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WGF Ref	EWA Ref	Respondent Country	1 Bradford UK	2 Dublin Rep of Ireland	3 Nijmegen Netherlands	4 Flanders Belgium	5 Mainz Germany	6 Orleans France	7 Paris France
3	1	Scale of the Problem and Institutional Management							
3.2	1.1	Is pluvial flooding (on its own or as a part of surface water flooding) recognised as a potential flooding problem?	Yes - In the UK it has only been recognised since the Foresight Future Flooding Report in 2004	Yes	No , it is not a real threat in our region.	Any type of flooding that occurs is recognised, but there is no clear distinction being made between the types of flooding.	In the suburbs of Mainz : Yes . In Zollhafen Mainz : No .	Yes it is. People and activities are visibly affected by damages. It's a real problem for the public utility which slow to act because the area and the nature of the disaster can't be defined before the end of the event. It's often filed in unacceptability risks, because, for most people, it's an deviance in urban settlement. This kind of risks is characterized by lack of urban settlement (saturation of underground system, sealing ground), and not by natural climate event.	Yes of course, in Metropolis area of Paris, a lot of pluvial flooding occurred.
3.6	1.2	If so, are there particular areas that are considered to be particularly vulnerable to this type of flooding or is it considered to be a risk in all areas of the country?	All areas.	All areas.		There is a risk in all areas of the Flemish region, but of course damages and risks are higher in built areas.	Particular areas in Mainz : Yes . In Germany : Not in all areas. In hilly regions : Yes .	In France, almost all the country is concerned by this risk. But, some areas are particularly vulnerable: where storm are violent, and affect urbans areas. For example, in the Greater Lyon, many cities are affected by pluvial flood several times per year. And everytime, the damages are similars: the roadway is broken or blocked by some urbans things (tree, utility pole).	I don't have any studies that make state of art of pluvial flooding in Ile de France region. But if you look at this web site http://www.prim.net/ you will see in each municipality the number of event since 1982 (example for Ivry sur Seine : http://www.prim.net/cgi_bin/cloay_en/macommune/bddrm_detail_commune.php?insee=94041). In Ile de France, you can find generally a minimum of 5 pluvial flooding events for the last 30 years. Sometimes some municipalities were flooding about 10 times since 1982 with pluvial flooding (Paris by the way) : http://www.prim.net/cgi_bin/cloay_en/macommune/bddrm_detail_commune.php?insee=75056 . So we can consider that urban area of Ile de France is particularly vulnerable to this type of flooding. But in urban or sub urban sprawl areas, we observe several new pluvial flooding that don't exist before urban development. In some rural areas, we also observe pluvial flooding, where heavy rainfall couldn't infiltrate into the ground.



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-	1.3	Is pluvial flooding distinguished from flash flooding? Is it regarded as more or less of a problem that flash flooding?	Not always, but generally flash flooding has been more severe.	Yes – In Dublin regarded as a separate problem	Flash flooding, especially when it concerns our rivers is regarded a much bigger threat than pluvial flooding as damage is much higher.	As already mentioned in answer to question 1.1, there is no real distinction made between pluvial, flash flooding and surface water flooding. Even the definitions above show the impossibility of making clear distinctions: flows that cannot enter sewer systems because they are already full to capacity are considered as pluvial floods, and flows caused by exceeding the capacity of underground systems due to heavy rainfall are considered as surface water flooding. Usually these two events coincide. Flash floods occur in rural areas of the southern part of Flanders where loamy soils are located on hill slopes. They are the cause of local mud streams, leading to loss of soil, affecting roads and houses by mud and flood water and increase of sediments in downstream watercourses. They are considered as harmful and a lot of measures are in place or planned to prevent these events (e.g. http://www.unifip.com/online-magazines/3/20901/36707/pub/index.html) Pluvial floods can occur anywhere, also in urban areas, where in theory the potential damage is higher	Yes - Pluvial flooding is distinguished from flash flooding, yes. It's regarded as an own problem.	It depends where you stand. When it's the land is drained by many small rivers, the problem is considered in his global system. But, when you've got the main stream of water, which hasn't got a torrential system, the difference is clear for the risk management organization.	I don't think there is a difference between the both. But, in France, generally we speak about "flash flooding" in the south part of the country, where the rain can have very high intensity (more than 100 mm per 24 hours, sometimes 500 mm or more per 3 or 4 hours) We speak more about pluvial flooding (local storm) in the urban areas (everywhere in the country) To summarise, flash flooding is more considered as a very fast natural phenomena and pluvial flooding more considered as a urban dysfunction.
3.7	1.4	Is pluvial flooding more of a problem in urban areas or rural areas or both?	Rural and Peri-urban areas are more problematic.	Both	As far as it is relevant, it is of a bigger concern to urban than to rural areas.	Pluvial flooding can occur both in urban and rural areas . In urban areas due to overflow of combined sewer systems or road tunnels. The damage in urban areas depends entirely on the design criteria of the sewer/drainage systems. These design criteria are now under review in relation to climate change scenarios. In rural areas pluvial flooding occurs in two cases: when the soil is saturated after a longer period of rainfall, or when the soil is very dry in summer conditions. In flatland areas this is not recognised as a serious problem. Only in hill sloped rural areas pluvial floods and flash floods are seen as the same kind of event.	Both, in hilly regions : Water flowing into the city /village.	The problem is not a question of urban or rural area. The problem is bigger when the vulnerable elements are plentiful. Because the costs become bigger and the number of potential accidents and victims grows up too. Nevertheless, this point of view has to be moderate: in rural areas, there're much possibilities to drain off as in urban areas. The damages could be less than in an urban center, but, the hazard is the same and concerns the both kinds of areas.	We can observe pluvial flooding in most parts of the country , because when you have high intensity of rain, most of the time you have fast flow.
3.1	1.5	Is pluvial flooding (or a similar type of flooding) defined in national legislation or guidance? If so please provide details.	Yes Statutory Instrument 3042: The Flood Regulations 2009	Not separately defined – Office of Public Works Guidance would describe it as a third option to Fluvial & Coastal.	I do not know.	The Flemish Decree on Integrated Water management (18/07/2003) is the basis for all water related issues. The implementation of the EU Floods Directive will soon be integrated in this decree. In this update "flood" means the temporary covering by water of land not normally covered by water, caused by e.g. flooding from rivers and flooding from the sea. So pluvial flooding or flash floods are not excluded from the decree, but they are not defined as such.	In guidance: Yes The pluvial flooding has to be considered in planning or development projects. It's not allowed to dump pluvial water into the sewers. Pluvial water has to be retained or separately drained, if possible.	-	To define the size of pluvial pipe, state guidelines (the rule) demand to take into consideration the 10 years rainfall. I don't have any information for the sewer pipe.



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3.3	1.6	Which authority is responsible for performing the Preliminary Flood Risk Assessment under Article 4 of the Floods Directive (2007/60/EC)? How does it intend to proceed with assessing pluvial flooding risks?	Both the UK Environment Agency and the Municipality designated as Lead Local Flood Authority under the above SI 3042: Guidance on the requirements are still being finalised	The Local Authority ie Dublin City Council. We are assessing it as part of EU Project Flood Resilient City. At the same time OPW has undertaken a national assessment .	It is both the water board and the municipalities that are responsible: for the water system and the built environment respectively.	Flanders will not perform the Preliminary Flood Risk Assessment.	In Germany: The "Länder" (federal states) and the City Authorities .	It's the Minister (and the Study Commission) which has got to do it. It's still in debate today for transferring the directive in French law.	This is state government . We don't have any information about the methodology yet.
3.4	1.7	Is there an active participation of local authorities to manage pluvial flooding (or surface water flooding) and assess risks from this type of flooding? If so, how does it happen?	Yes , but the degree to which it happens varies and there is no current standard approach.	Yes we are actively participating in its assessment. No if the question means between Local Authorities.	Mainly in prevention of floods , by taking adequate measures to prevent it by planning enough green spaces, infiltration and discharges.	Management of pluvial flooding is a local scale responsibility (municipalities, polders, water boards, provinces, waste water treatment companies). The water management planning in Flanders is organized on 3 different levels (river basin, basin, sub-basin), where the sub-basin level is the responsibility of these local managers, taking into account the principles and objectives of the plans on a higher level.	Yes . Pluvial water has to be retained or separately drained, if possible.	Yes . Many developer contractor take place in this think tank. The intention is to integrate the practical parameters and to incorporate the whole experts point of view with rich experience.	Yes . State government decides the rule and local authorities (municipalities) have to respect it to size the different type of pipe or water course.
3.5	1.8	Are any institutional changes in this respect anticipated by the transposition of the Floods Directive (2007/60/EC)?	Yes , the SI 3042 was introduced in December 2009 and there will be more new legislation in 2010; the Floods & Water Management Bill and further secondary legislation which so far has not been determined.	No	-	No .	No .	-	To my mind it's too early to know that. I didn't observe that.



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WGF Ref	EWA Ref	Respondent	1 Bradford	2 Dublin	3 Nijmegen	4 Flanders	5 Mainz	6 Orleans	7 Paris
		Question Country	UK	Rep of Ireland	Netherlands	Belgium	Germany	France	France
4/2	2	Data and Records Available on Pluvial Flooding							
4.1	2.1	Are records of pluvial flooding (or surface water flooding) gathered?	With any consistency only since 2004	Yes	-	<p>In Flanders two kinds of records are available in detailed maps (level of detail at least 1:10.000):</p> <ul style="list-style-type: none"> - historically or naturally flooded areas (NOG map) based on the detailed Belgian soil maps with delineation of soil without profile development (colluviums in hill sloped areas caused by historical mud streams, alluviums in river valleys caused by historical river floods and polder grounds in areas below sea level and so historically flooded by the sea) - recently flooded areas (ROG map): these demarcate the effectively flooded areas in Flanders that were recorded between 1998 and present. Pluvial flooding is also incorporated in these maps, without difference from other types of flooding. <p>Further we also have maps with the modeled flooded areas (MOG), based on hydrologic and hydraulic modeling of all rivers with a catchment of at least 5.000 ha, and ever a lot of smaller ones.</p>	Yes (by the communities)	The Water authority gathers this information. But the link with another operational department doesn't exist in many cases.	Yes
4.2	2.2	Which is the body in charge of collecting data relating to pluvial flooding (or surface water flooding)?	Both the Council's Drainage and Emergency Planning Sections both collect data.	As the question is asked OPW will collate all data supplied by the Local Authority but it is the Local Authority which actually collects this.	-	<p>In Flanders two kinds of records are available in detailed maps (level of detail at least 1:10.000):</p> <ul style="list-style-type: none"> - historically or naturally flooded areas (NOG map) based on the detailed Belgian soil maps with delineation of soil without profile development (colluviums in hill sloped areas caused by historical mud streams, alluviums in river valleys caused by historical river floods and polder grounds in areas below sea level and so historically flooded by the sea) - recently flooded areas (ROG map): these demarcate the effectively flooded areas in Flanders that were recorded between 1998 and present. Pluvial flooding is also incorporated in these maps, without difference from other types of flooding. <p>Further we also have maps with the modeled flooded areas (MOG), based on hydrologic and hydraulic modeling of all rivers with a catchment of at least 5.000 ha, and ever a lot of smaller ones.</p>	Communities (rural authorities)	The GIS's Water's Office for instance for the Greater Lyon, and in general, the GIS Office .	State government is in charge of collecting data. But, sometimes local authorities do so with studies office.



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-	2.3	Are records of pluvial flooding combined with records of other types of flooding ? (Pluvial flooding can often occur at the same time as other types of flooding such as river flooding or sewer flooding. Nevertheless records of combined flooding are still valuable.)	All flooding is recorded on a single database .	Yes but up to now we were not aware that there was pluvial flooding - hidden - in the data	-	Yes , all combined in the ROG maps.	Yes , all kinds of flooding are recorded.	Yes . The data base incorporates these details.	Pluvial and fluvial flooding are combined in records of state government. Even if they know that there are many differences between both.
2.4	2.4	Are any criteria applied to assess the significance of a pluvial (or surface water) flooding event? For example rainfall intensity, extent and type of damage.	Not currently	Yes – Rainfall intensity; physical evidence e.g. overland flow.	-	On the ROG maps the extent of flood events, the period and the cause are recorded.	Yes : rainfall intensity, return period. Extent and type of damage: In preparation, corresponding to the EU Flood Directive 2007.	Yes The type of damage is distinguished of the other observations.	Yes Generally, in France we use, rainfall intensity and return period.
4.3	2.5	What is the content of records ? - Date and times? - Meteorological data? - Type of flooding? - Impacts (flooded areas, water depth, damage, loss of life)? - Causes?	All of the above, but not in every case.	Yes to all. (Type only since 2006/9). Causes where apparent.	-	Yes / No / No / Yes / Yes	Yes / Yes / In Preparation / In Preparation / No / No	-	Yes / Yes / Yes / Yes / Yes
4.4	2.6	What is the period covered by available records?	From 2004 with any degree of completeness, more historic data exists but there is no standard format to it.	From 2006/09 for strict pluvial flooding	-	Records for ROG maps are gathered since 1998 .	Minimum last 30 years.	The best data bases cover the 20 years , and furthermore the 10 lasts.	That depends on the region. I'm not sure, but I don't think that available records for pluvial flooding (high intensity rainfall per hour or minute) exceed 40 years in France. Before 1960, intensity rainfall was calculated per 24 hours. Satellite observations improved that calculation since 1970's and mostly 1980's.
4.5	2.7	In what formats are data available?	Both electronic databases and hard copy for older records.	Various Word reports; excel rainfall records	-	Shape files	Not in all cases: Excel	It's different for many organization, because of the using of different GIS .	Intensity per minutes or per hour



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WGF Ref	EWA Ref	Respondent	1 Bradford	2 Dublin	3 Nijmegen	4 Flanders	5 Mainz	6 Orleans	7 Paris
		Country	UK	Rep of Ireland	Netherlands	Belgium	Germany	France	France
5	3	Guidance on Mitigation Measures							
5.1	3.1	Is national guidance available which is relevant to managing the risk of pluvial flooding (or surface water flooding)? If so please provide details.	Yes through various from various agencies Defra, CLG and CIRIA being the main ones	No separate pluvial flooding guidance	-	In Belgium this is a regional matter, so legislation is made on the level of the different regions <i>Legislation on spatial planning:</i> There are planning regulations that oblige people for any new development (buildings and sealed soils) to collect, reuse, infiltrate and/or buffer rainfall water before discharging it to surface water or sewer system. <i>Legislation on agricultural land use:</i> with farmers' agreements concerning management are made, they receive subsidies to take erosion control measures. <i>Legislation on water management:</i> (1) The water assessment tool is in place to make sure that new plans and building permits take into account the objectives and principles of the Flemish decree on integrated water management, in order to prevent adverse consequences on the water system, including compensation measures to prevent additional flood risks on other assets. (2) Code of good practice for the design of sewer systems and rainwater discharge, with design criteria for sewers, rainwater harvesting, infiltration, and buffered discharge of rainwater. Now under review taking into account climate change scenarios.	Yes. The guidance gives order for planners and developers how to deal with pluvial floods.	-	-
5.2	3.2	Is other guidance used? If so please provide details.	-	Yes - OPW publications	-	-	No	-	-
5.3	3.3	Are measures already applied to deal with pluvial flooding (or surface water flooding)? If so please provide information on the types of measures applied under the broad categories of: • Infrastructure / conveyance • Source control and overland flow routing/storage • Non structural measures • Other measures	No	No - these are being developed under FRCproject	-	Yes Controlled flooding areas / small scale flooding areas; erosion control plans (subsidized to municipalities by Flemish authority) and measures; mandatory rainwater tanks, infiltration and buffer facilities / promotion and subsidies for sustainable agricultural techniques	Yes / Yes / - / Retaining pluvial water in its catchment areas. In the hills, the woods, the meadows.	-	Infrastructure: 1/10 years rainfall, size of the catchment, streaming coefficient and slope for pluvial pipe. Not known. Not known. Not known.



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Summary of Discussion Points



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Discussion Points

This Workshop can:

- Promote **exchange of ideas** in pluvial and surface water management and encourage new and **innovative approaches** and techniques across Europe.
- Present exciting opportunities to contribute to **improved understanding** in urban flood management and dealing with **pluvial and surface water flood risk**.
- Support **evolving good practice** in pluvial and surface water management.

We need to consider:

- What we can **learn from the questionnaire** responses.
- **Key issues**.
- Needs for **further guidance and research**.



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Thank you for your attention



Questions?

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