

Interreg RainGain Project
UK 3rd National Observers Group
21st March 2014.

Interreg IVB FloodResilienCity
DEVELOPING DUBLIN'S
PLUVIAL FLOOD RISK MANAGEMENT
STRATEGY



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Project Manager (Former)
Dublin City Council
EU Interreg IVB FloodResilienCity Project

Contents:

1. Dublin Flooding Initiative
 - Multiple hazards - single strategy.
2. Dublin City Pluvial Flooding Study
 - Quantifying a new urban flood risk
3. Implementation to date
 - Bridging the city scale forecasting gap
 - Managing exceedance
4. Conclusions & Next Steps
 - Administrative & functional changes
 - Community Resilience & Adaptation
5. Acknowledgements
- A. Appendices



Pluvial Flooding Clanmoyle 2008

Dublin Flooding Initiative (DFI)

Evolution of DFI Strategy.

- Established 2002 following major coastal & river flooding.
- Modelled on Dublin Transportation Initiative
 - Up to 1990's - more roads.
 - This was unsustainable.
- Dublin Flooding Initiative (Pluvial):
 - Sustainable Drainage Systems.
 - "Streets as Streams".
 - Water Sensitive Urban Design.
- DFI has been a central DCC theme in several EU Interreg projects.

Activity, 2002/2014 – a strategic progression:

- Reliance on structural defences.
- Integration of defence and response.
- Spatial Planning & Adaptation.
- Community Resilience.

The five pillars of the DFI:

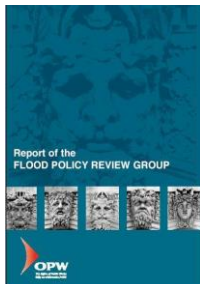
1. Dublin's five major flood risks:
2. Irish National frameworks
3. All Hazards Major Emergency Plans
4. EU Partnerships & Learning Alliances
5. Other Learning & Support Alliances

1.2 Irish National frameworks

National Flood Policy Review 2003

- Review of causes, extents & impacts.
- Roles & responsibilities of main state bodies etc.
- International best practice.
- Future policy proposals.
- Proposals for organisational structures & responsibilities.

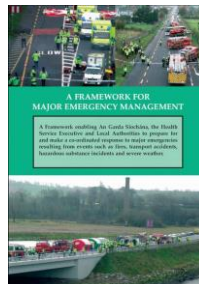
OPW
Office of
Public
Works



Major Emergency Management 2006

- Identify & rank ALL Hazards & Risks.
- Draw up MEM Plans & Sub Plans.
- Lead Agency has mandate for co-ordination function.
- Local Authority is Lead Agency in a flood event.

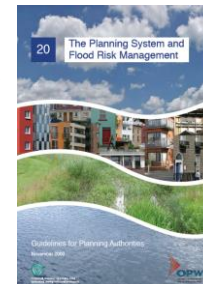
DEHLG
Dept of
Environment
Heritage &
Local
Government



Planning & Flood Risk Management 2009

- Avoid the risk, where possible,
- If not substitute less vulnerable development,
- If unable to substitute, mitigate & manage risk
- States the stakeholder tiers.
- Planning co-ordinated with:
 - River Basin Management Plans
 - Flood Risk Management Plan

DEHLG
&
OPW



But , 2014

- No National Agency for:
 - Flood Forecasting.
 - Flood Warnings
- Irish Water 2014 now has some drainage functions including:
 - Foul sewerage
 - Combined drainage:

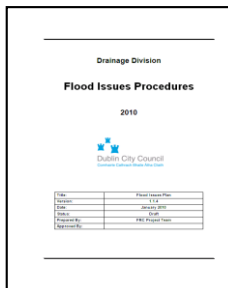
These are scenarios in virtually all of the city centre

1.3 All Hazards Major Emergency Plans

DRN PROC (Drainage Procedures)

- Drainage – “Trigger Division”
- Flood issues – housekeeping & FRM.
- Prevention & management of floods within resources
- Forecasting & monitoring.

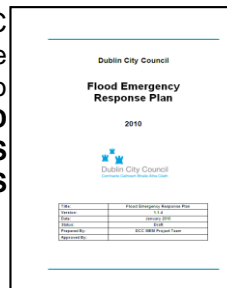
Procedures for dealing with **FLOOD ISSUES** including Flood **FORECASTS**



DCC FEP (Flood Emergency Plan)

- LA Lead Authority (floods)
- FRM of Flood events within DCC corporate capabilities.
- Liaison with other agencies and Local Authorities.

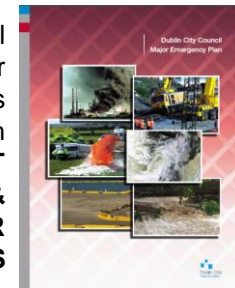
DCC Corporate response to **FLOOD INCIDENTS & EVENTS**



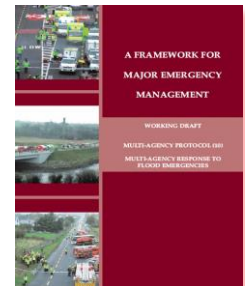
DCC MEP (Major Emergency Plan)

- LA Lead Authority (floods)
- Major Flood Emergency
- All Hazards & Agencies
- Flood Protocol 10
- Other linked Plans e.g. Evacuation Rest centres

Activation of all Responder Agencies to deal with **SIGNIFICANT & MAJOR EMERGENCIES**

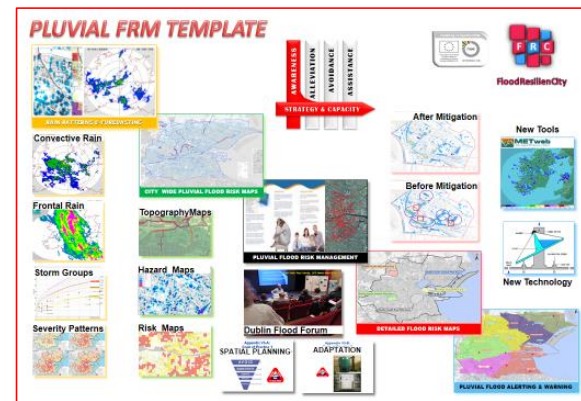


PROTOCOL 10 For Coordinating FLOOD RESPONSE



1.4 European Projects

1

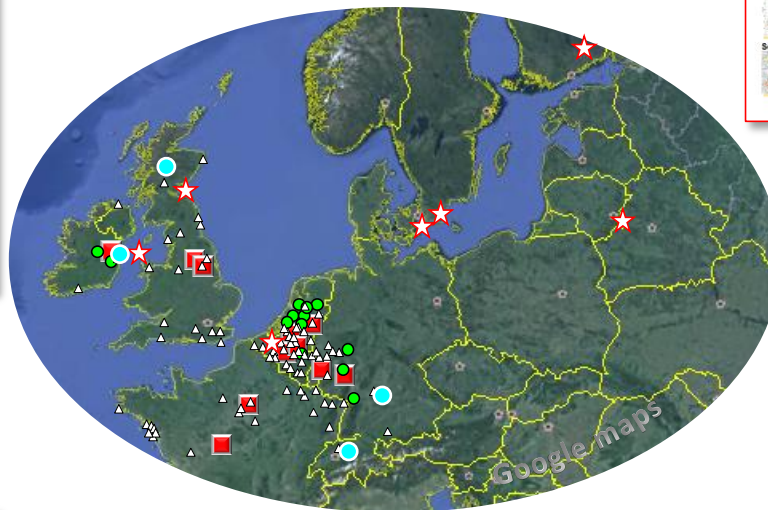


INTERREG IVB

SiCadapt!

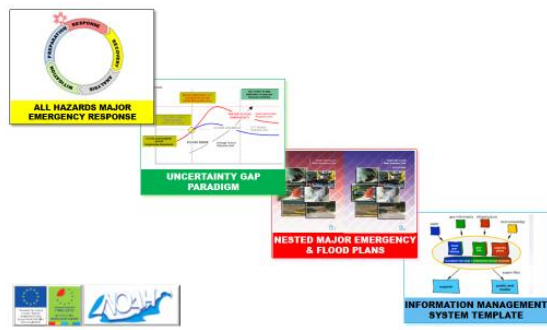


Spatial Adaptation to Climate Change
Adaptation Toolkit
EU Policy recommendations



INTERREG IIIB

FLOOD EMERGENCY RESPONSE



DG CLIMA



EU CITIES ADAPT
Northern Europe Group



THEMES:
Climate Change Adaptation
Multi sector
Peer learning alliances

1 See Appendix for higher resolution.

1.5 Other Learning & Support Alliances:

IBM Smarter Cities program.

Dublin – a participating city

Deep Thunder:

- Research modelling tool.
- Bridge city-scale forecast gap.
- Potential being explored.



Scottish Flood Forum

Pluvial Study Learning Alliance.

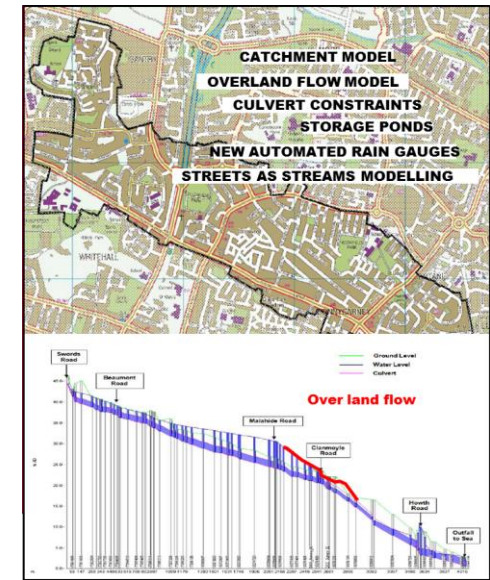
Dublin Flood Forum:

- Based on DFF model
- 5 city communities
- 12 month pilot
- Report due 2014 Q2.



CIRIA

- Corresponding organisation.
- Contributor with case studies.



Dublin City Pluvial Flooding Study

First major strategic study into the phenomenon of pluvial flooding in Dublin.

Undertaken by Dublin City Council as a major regional work package in the:

EU Interreg IVB FLOODRESILIENCITY PROJECT

Service provider - Jacobs Engineering Ireland.

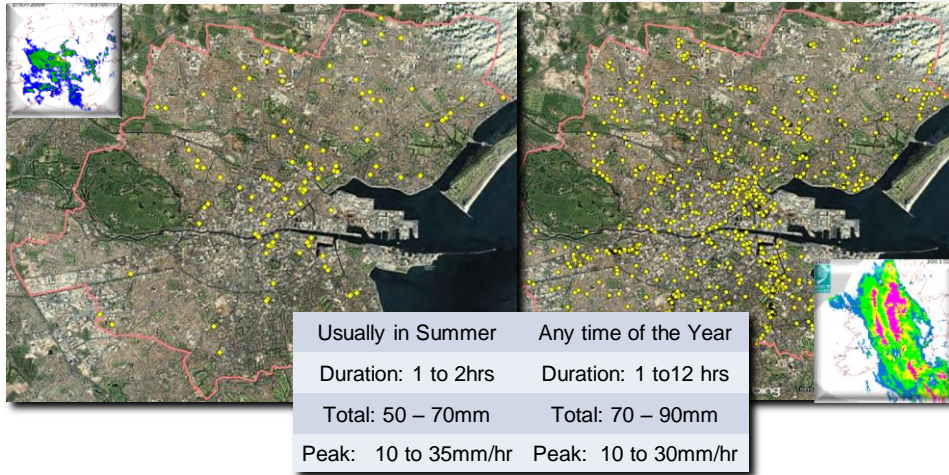
The Study report comprises:

- Non Technical Summary
- Technical Volumes 1 to 5
- Review of Flooding Event (24/10/2011)

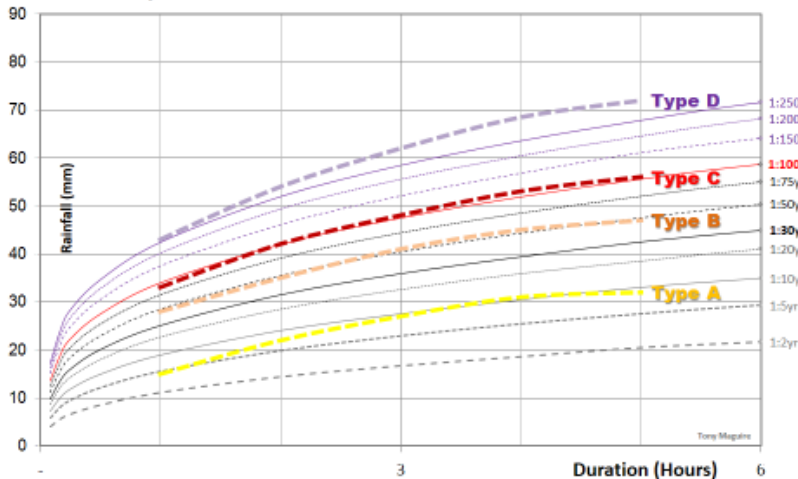


Vol.1 – Rainfall & Forecasting

Convective v Frontal Pluvial Events

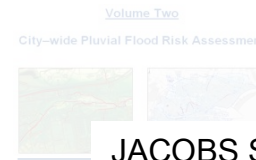
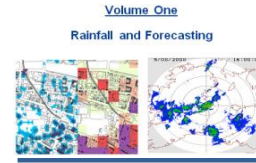


Dublin City Rainfall Patterns.



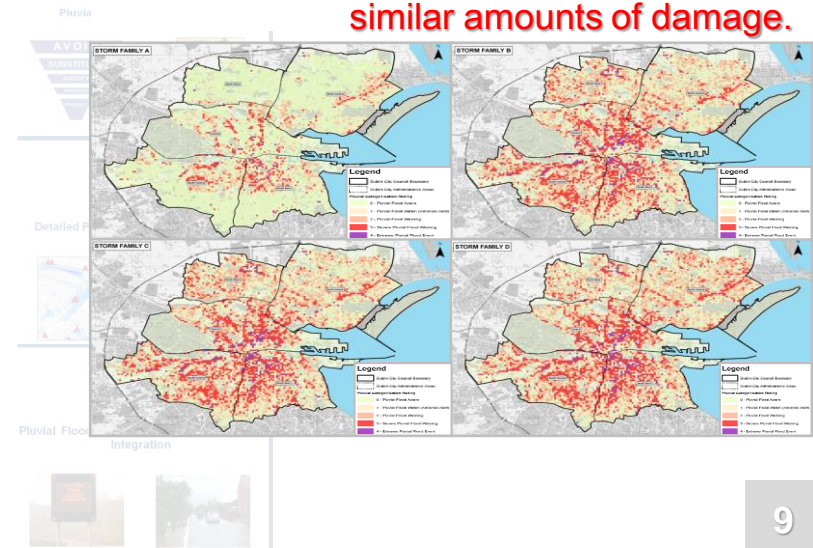
Understanding:

- rainfall & flooding mechanisms
- pluvial storm categorisation
- pluvial flood forecasting & warning



JACOBS STORM FAMILIES A; B; C & D

Different returns & durations grouped by -
similar amounts of damage.



Vol.2 - City Wide Pluvial Flood Risk

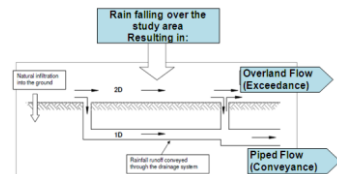
Pluvial Flood Hazard Analyses

DRY MAPPING

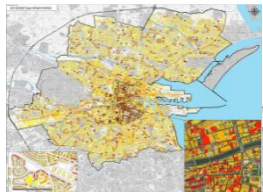
1. Flow paths
2. Collection points
3. Topography character & obstacles

WET MAPPING

1. Drainage model catchments (6no)
Computed conveyance allowances
Various model runs
Irish rainfall depth durations



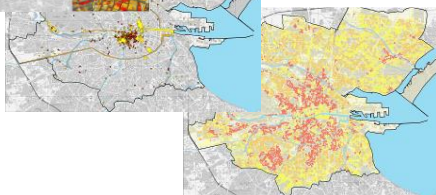
Risks to:



1. Human health & critical infrastructure.

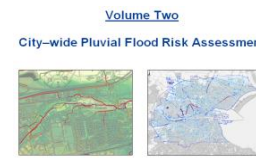
2. Environment & cultural heritage.

3. Economy.



Understanding:

- overview modelling & mapping.
- preliminary flood risk assessment



- Flat topography
- Deep ponding areas
- Critical paths /obstructions
- Many properties with low level access
- 18,000+ inhabited **basement** properties.



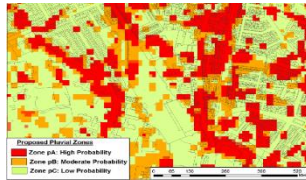
Vol.3 - Flood Risk Management:

CoP1 New Development

Spatial Planning & Building Regulations

Compatibility with DEHLG/OPW guide lines.

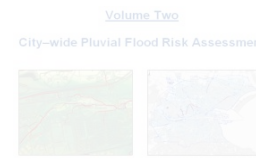
- Pluvial flood risk assessment & sustainable planning & building control.
- FRC deliverables informing pluvial flood risk assessment.
- Proposed zoning.



CoP2 Existing (&New) Development

Flood Resilience & Adaptation Measures

- Measures especially for existing development.
- Driven by risk mapping which identifies:
 - 1. Generic & early win/win Measures**
 - 2. Community Resilience Measures**
 - 3. Site Specific Measures**



Understanding:

- Resilience & Adaptation
- Proposed Codes of Practice (2).
- Toolkit of measures.
- JACOBS' "FAB Plus" approach

THE FAB PLUS APPROACH

- Aim for multiple 'wins' across more than one sector.
- **FAB-Plus** test:
 - F**lood Risk Mitigationa 'given'
 - A**menity Enhancement
 - B**iodiversity Opportunity
 - Plus**.....
 - Carbon reduction /sequestration
 - Waste re-use
 - Potential for Regeneration Uplift
 - Recreational enhancement
 -and others?

Vol.4 - Detailed Risk Assessments

PILOT AREAS

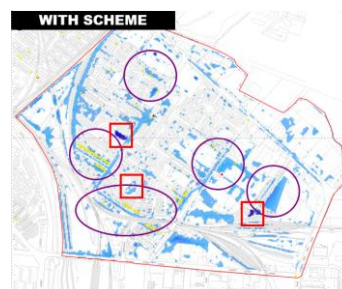
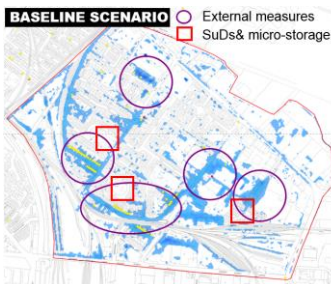
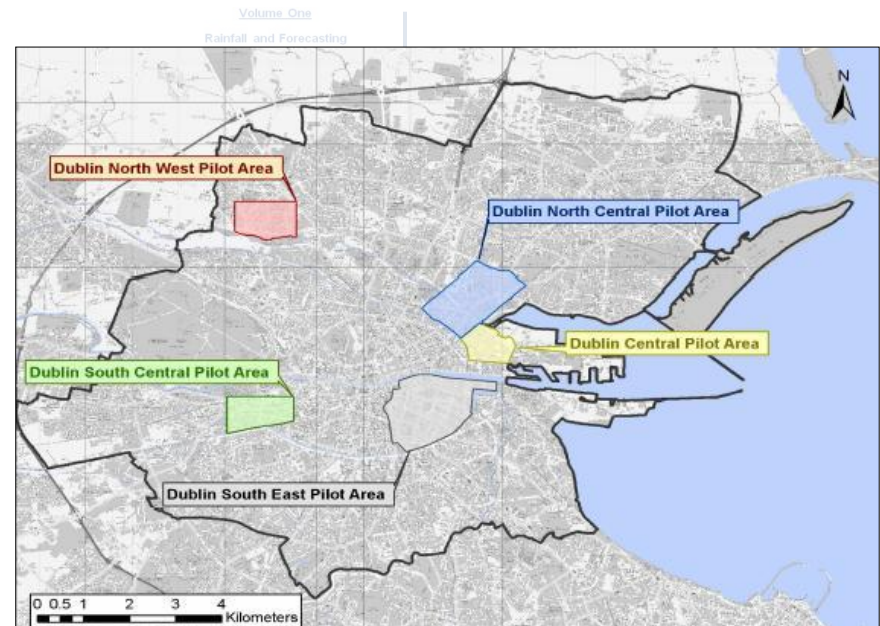
- DCC is divided into 5 local administration areas
- Basis for community engagement
- Pilots identified in areas of :
 - Higher pluvial risk,but also with significant risks of:
 - Coastal
 - River
 - Drainage
 - Dam

INFORMATION

- Time series maps
- Before / After Scenarios

Understanding:

- Five Pilot Areas.
- Models at 5m grid scale.
- Linked to 1D drainage model
- Time series maps
- Before & After scenarios



Volume Four
Detailed Pluvial Flood Risk Assessment
of Pilot Areas



Volume Five
Pluvial Flood Alerting and Warning System
Integration



Vol.5 – Flood Alerting & Warning

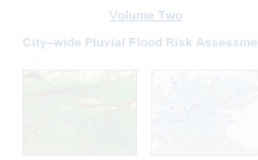
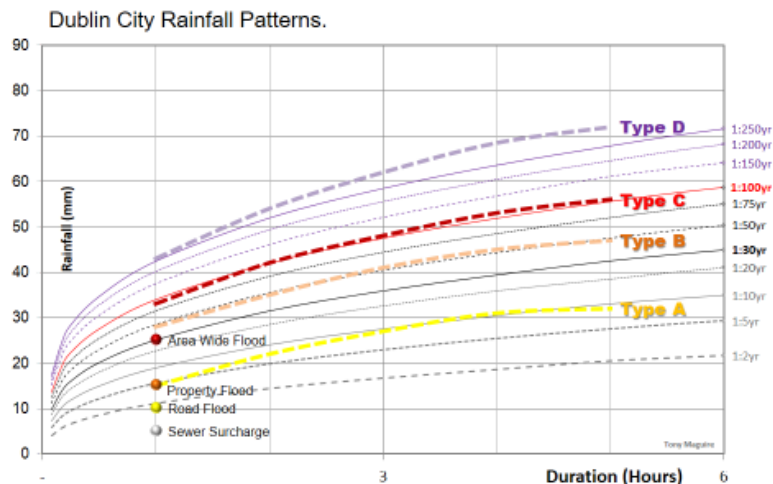
Understanding:

- Pluvial flood alerting
- Pluvial flood warning
- Development of DCC Initiatives

Flood Alerting & Warning Systems

Outlined

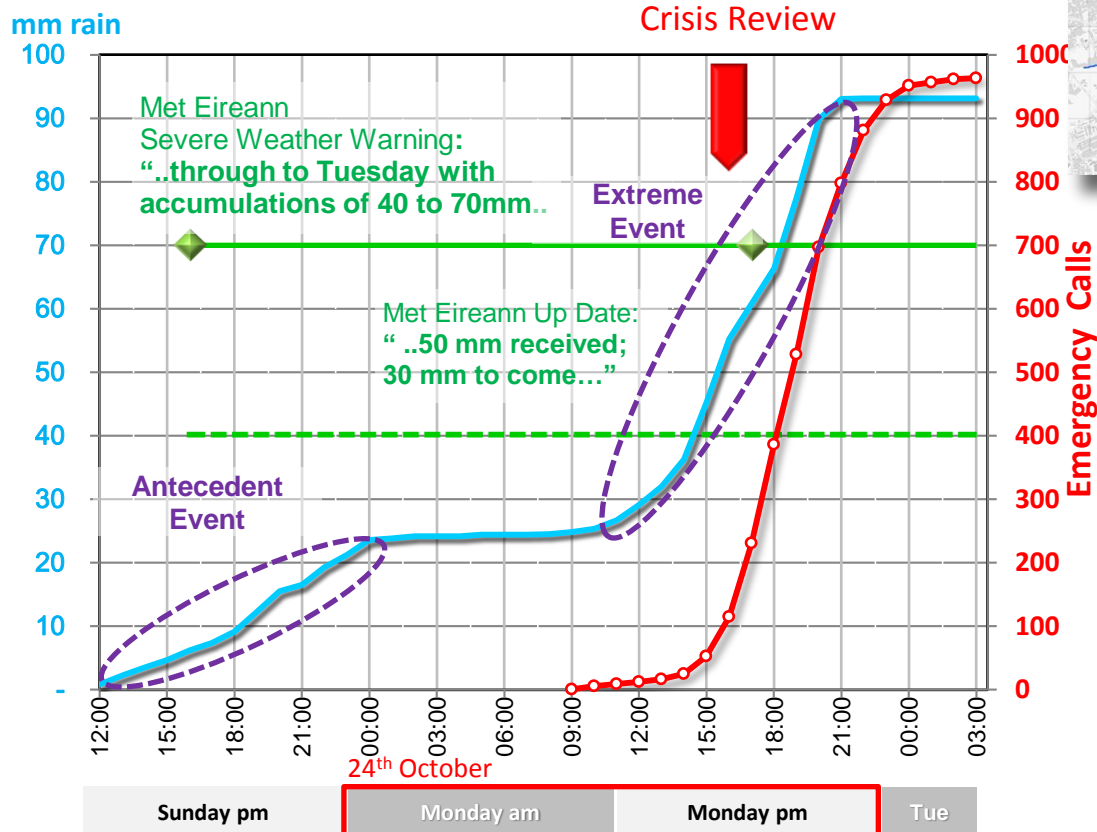
- Technologies available
- New Technologies
- Integration & augmentation of the existing rain gauge network.
- Proposed expansion of the existing Dublin rain gauge network.



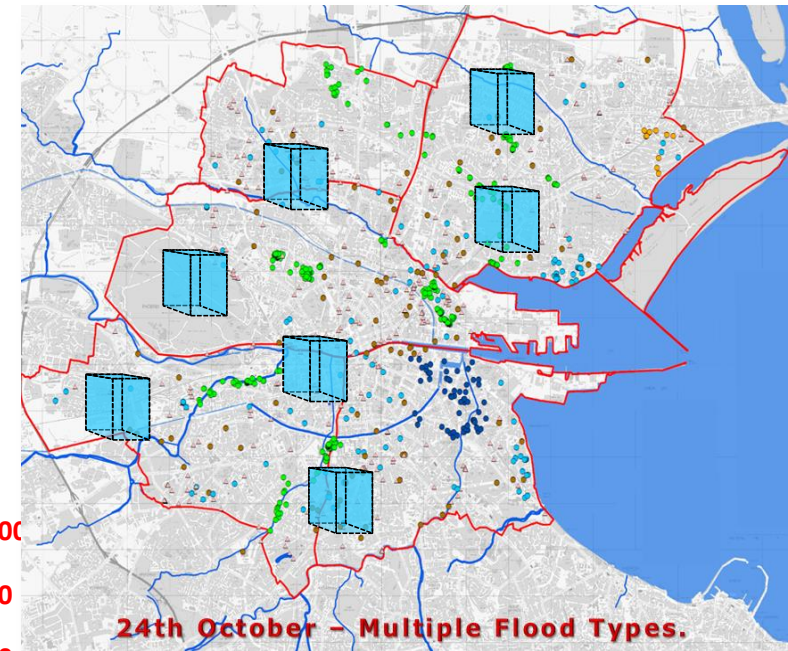
24th October 2011

1st October Forecast & observed - was almost identical.

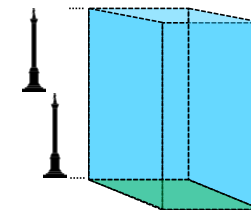
So why was 24th so severe?



Fluvial: ● Fluvial/Pluvial : ● Foul : ● Pluvial : ● Pluvial/Drainage : ● Drainage : ● Unknown : ▲



10.5 Mega Tonne Rain over the city.



Twickenham Rugby Pitch Plan Area
X Twice height of Nelsons Column
= 1.5 Mega Tonne

Implementation (to date)

DCC uses a number of complementary techniques to manage Urban Exceedance.

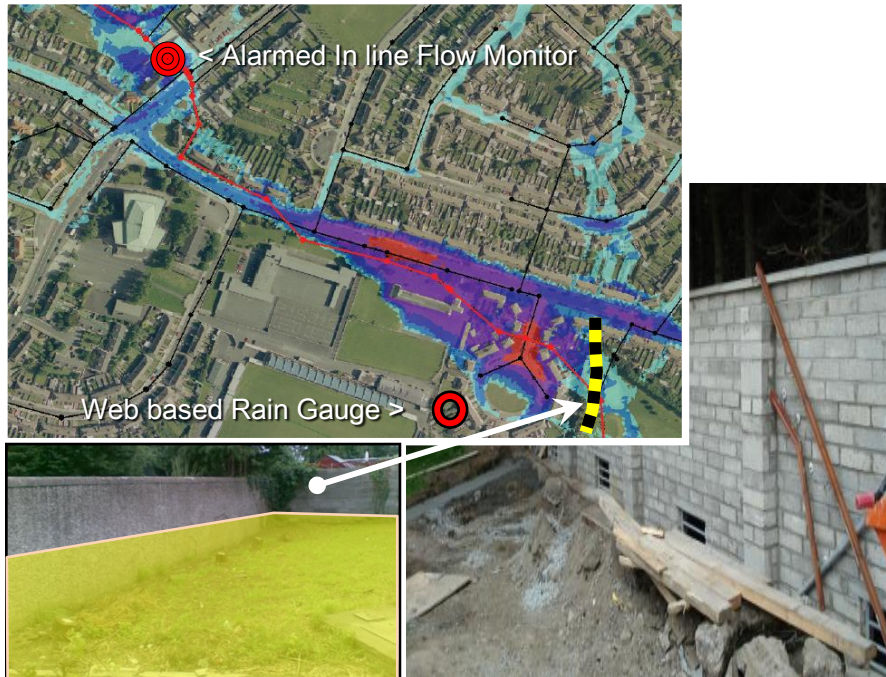
These include:

- SuDs
Sustainable Drainage Systems
- WSUD
Water Sensitive Urban Design
- SaSRaR
Streets as Streams Roads as Rivers
- Operations



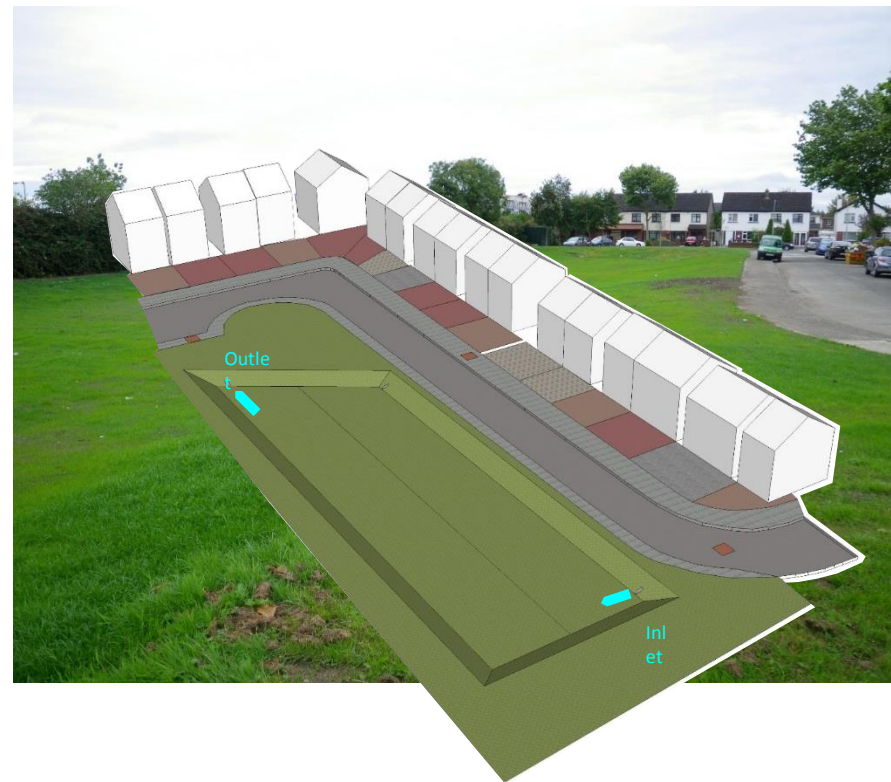
Managing Exceedance – SaSRaR & SuDs

Glendhu Park - Swale



ESTATE WALL –
CONTAINING BARRIER

NEW BOUNDARY - TO **RELEASE**
FLOOD TO ADJOINING GOLF CLUB



Clanmoyle Estate - Streets as Streams

Managing Exceedance – Main Streaming WSUDs

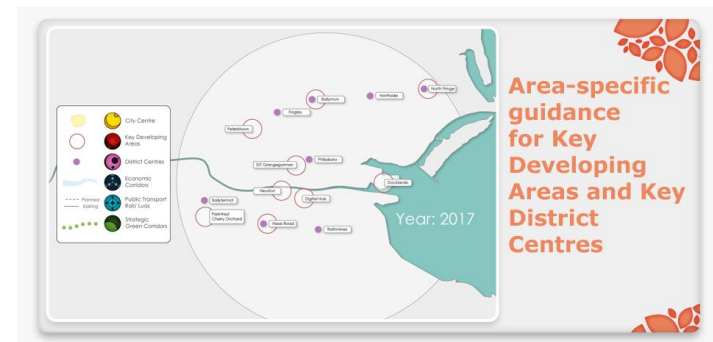
1. FRC close collaboration:

- DCC Planners
- Drainage
- FRC

2. Planners - Local Area Plans

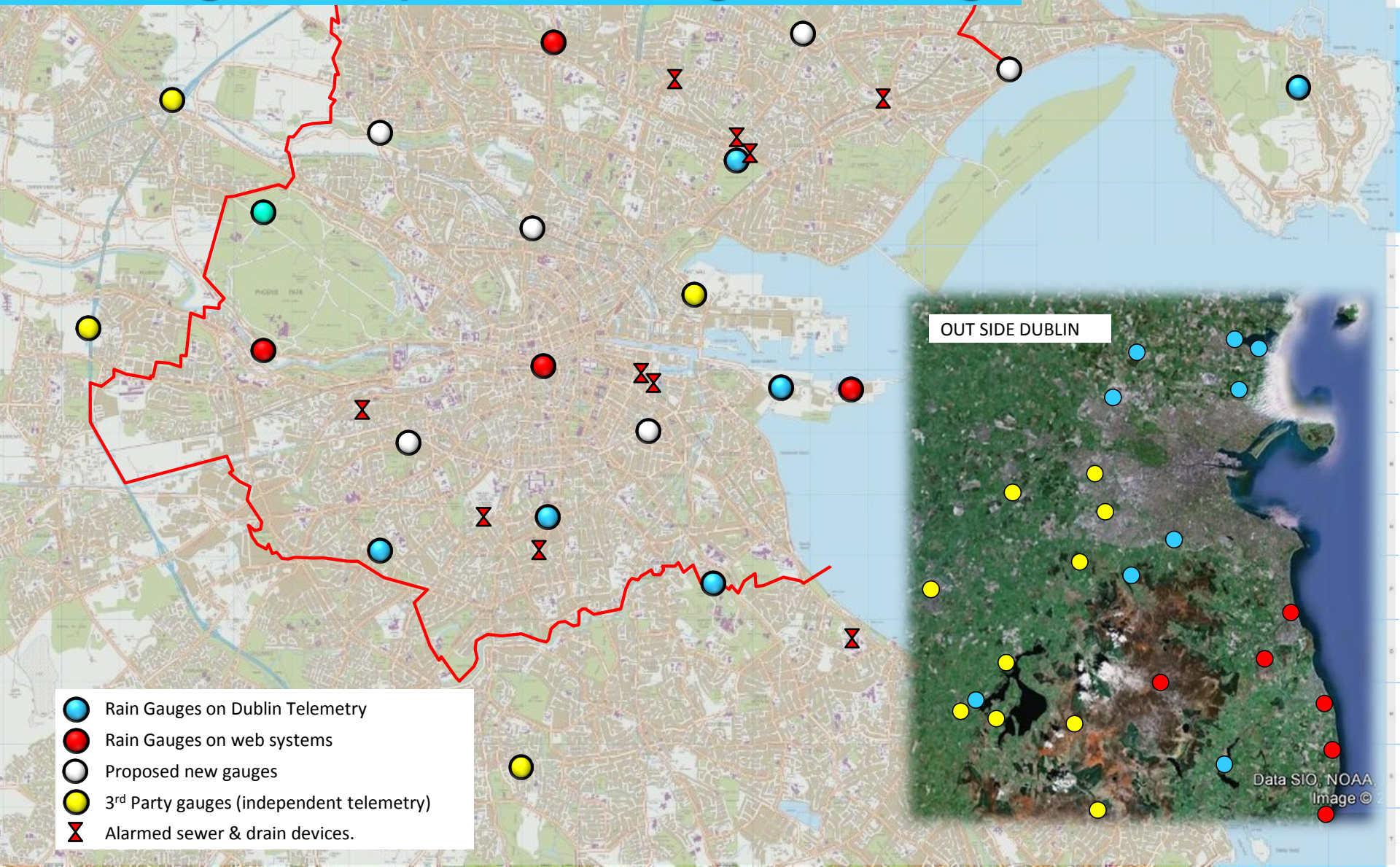
- Joint workshops & LAP reports.
- Embed pluvial FRM in the plans
- Schedule 25 – list green SuDs to note (& protect) flood alleviation aspects.
- Proposal to mainstream Adaptation in next review (2014).

1. Dublin City Development Plan



APPROX POSITIONS

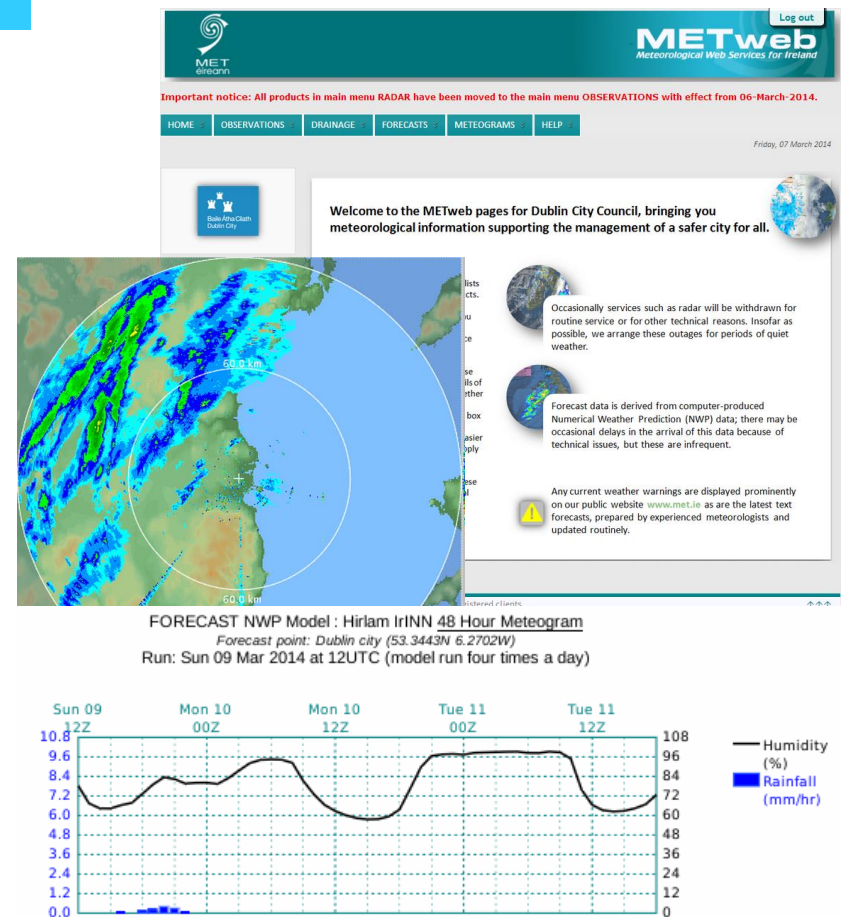
Closing the Gap - Monitoring & Alerting.



Closing the Gap – METweb.

Met Eireann - dedicated web page:

- Met Eireann ftp site hosts the Triton coastal forecasting system developed under the SAFER project.
- METweb is a further development which provides DCC with city scale & near city pluvial weather information.
- It provides dedicated information on
 - Harmonie 1hr
 - Rain
 - Hirlam 3hr
 - Rain;
 - Thunderstorm
 - Wind & pressure
 - General forecasts
 - High resolution radar
 - 5min & 15min
- DCC FLAG use this to improve the effectiveness of their pluvial (as well as their fluvial & coastal) forecasting.



Community Resilience - Dublin Flood Forum

12-month pilot started in January 2013.

Information documents were developed and made available on DCC website

Specific Pilot Areas

- Dedicated team met the communities
- Individual Property Protection Assessments (IPPA's) were offered .
- 10% uptake by householders/property owners in the pilot areas.
- Follow-up survey by DFF has established that only a minority the IPPAs have been implemented so far.
- Report on the 12 month pilot is to follow.



Closing the Gap - FLAG ⁽¹⁾ Procedure.

1. If flood is threatened or likely the FLAG meets to assess risk

- imminence & magnitude.

2. FLAG comprises:

- Drainage Executive Manager
- Drainage Operational Section
- Flood Watch

(Gerry O'Connell & Tony Maguire)

3. Assesses severity of flood risk &:

- Develops action plan (& escalation):
Notifies other agencies.
Indicates if escalation of the Major Emergency Plan is anticipated.
- All flood types & combinations.

4. FLAG will:

- Re-Convvene several times as event unfolds
- Advise when the hazard has passed.

This assessment sheet is to be filled out by the group assessing any specific flood risk, either in response to an early warning or during a flood incident.

DATE		TIME 24 hr clock	
INPUT INFORMATION Met Eireann weather warning, output from Triton etc.			
HAZARD	1. Flood Clear	2. Flood Watch	3. Flood Warning
ASSESSMENT	4. Severe Flood Warning		
Tick box(es)			
Coastal			
Rivers			
Pluvial			
Drainage			
Dams			
ACTIONS			
INFORM			
	Drainage Operations	CMT	Corporate
	DFB	Civil Def	DCC Depts
	Other LAs	DECLG/ Gov	DBW
	AGS	HSE	Coastguard
	Army	ESB	Dublin Port
	Waterways Ireland	Other	
Tick boxes	DCC Departments		
By	Other Stakeholders		
MOBILISE			
Tick boxes			
By			
MONITOR BY	FDU	FRC / Triton	Drainage
Tick box			
DEPLOY DEFENCES	Flood Gates	Dutch Dams	Sand Bags
Tick boxes			
COMMENTS			
NEXT REVIEW	Location (or Conf Call)		Attendees
Fill in details			
SIGNED			

Conclusion & Next Steps

Dublin Pluvial flooding a confirmed risk.

- Increasing frequency & severity
- Aggravated by
 - Numerous basements & underground structures
 - Variable topography
 - Flat & steep and a congested city centre areas

FloodResilienCity project has provided:

- Innovative technical tool kit to address pluvial risk
- Specification for city-scale pluvial flood forecasting
- Framework for promoting community resilience
- Pluvial Flood Risk Management Strategy
- Template for management of pluvial flood risk.



Next Steps - Forecasting, Monitoring & Response.

Several functional changes:

- **National/Regional Flood Forecasting Agency**

Awaited with interest, but it is surmised that DCC will continue to generate their own for forecasts for the foreseeable future.

Unique local knowledge & track record of coastal forecasting.

- **Irish Water**

Operational January 2014, IW roles in flood risk management “contingent on infrastructural deficit”
Foul Sewerage/ Combined Drainage & Sewerage.

- **DCC Internal restructuring**

Drainage merger with Roads & Traffic; beneficial:

- Eliminate traditional drainage/roads design tension;
- Increased resources for flood monitoring.
- Traffic control as Crisis Management Centre.

DUBLIN CITY COUNCIL
ENGINEERS IRELAND CPD COMPANY
OF YEAR AWARD 2009

**CENTRE OF EXCELLENCE IN FLOOD
RISK MANAGEMENT**

“... and the resulting sophisticated coastal flood warning systems, a first in Ireland”.



New Traffic Control Room

Next Steps - Community Resilience & Adaptation

Changing conditions

- flood types & intensities
- climate change generally
- societal needs
- need to maximise Natural Capital etc.,

are driving a paradigm shift recognised in various EU initiatives including:

- Interreg IVB – SIC adapt!
Need to amalgamate multiple Action Fields
- DG CLIMA - EU Cities Adapt.
Close connection between CoRes & Adaptation

and by individual groups & practitioners
e.g.

- CIRIA & MWH
Multi (sector) benefits project.

Community Resilience & Adaptation

- DCC is pursuing a number of initiatives in CoRes which are intended to:

- A. Identify & empower this emerging tier in Local Governance
- B. Link the Quality of Life improvements with improved Resilience from specific hazards.

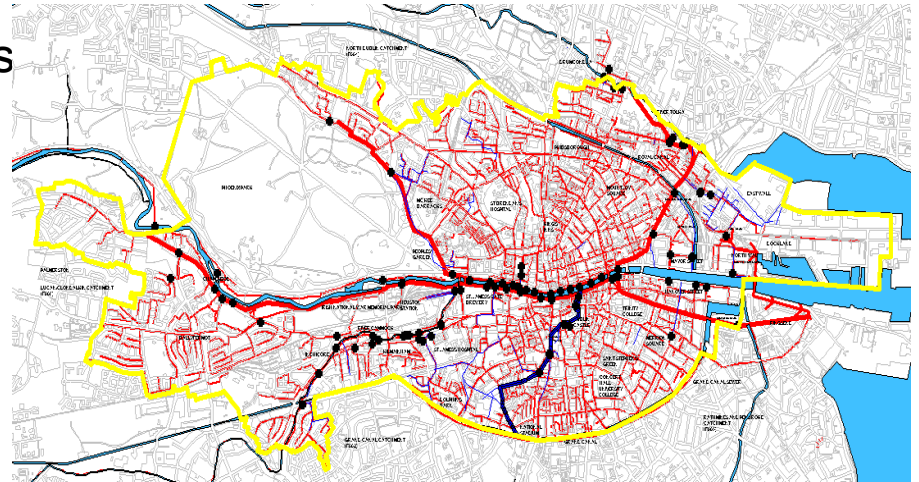
Next Steps – City Centre Sewerage Scheme (CCSS)

CCSS currently a strategic drainage study.

Will be help some pluvial choke points

- Improved hydraulic capacity
- Improved structural condition of conveyance network.
- Mitigate extreme basement flooding

The study approach advocates green networks.



Acknowledgements

Thank you for your attention.

The approval & encouragement of the Dublin City Engineer to prepare this presentation and to make extensive use of the available material is appreciated.

DCC acknowledge the invaluable support enjoyed throughout the Dublin Flood Initiative from:

- The Office of Public Works
- Met Eireann
- Interreg Partners
- DG Clima Partners
- Jacobs Engineering Ireland

Since the end of the FRC Project Dublin has confirmed its commitment to continuing European collaborations and the current team are listed opposite.

Tony Maguire, March 2014
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Dublin City Council EU Future Projects Team

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Appendices

- A1 Glossary
- A2 Coastal FRM Template
- A3 Pluvial FRM Template

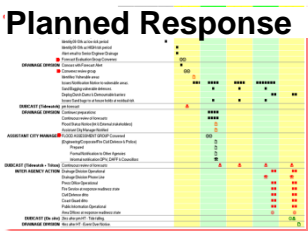
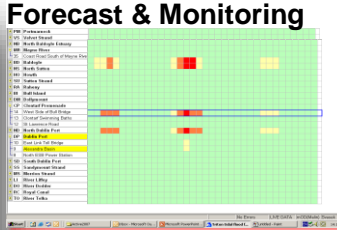
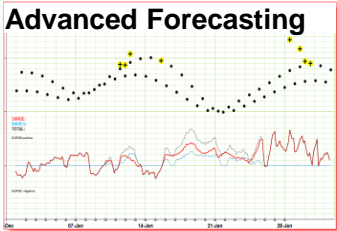
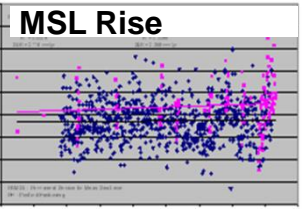
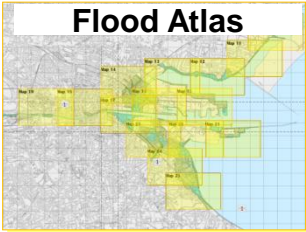
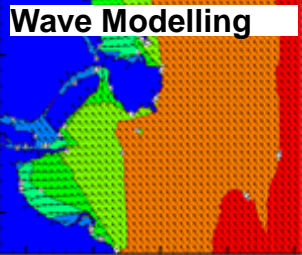
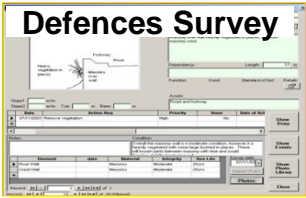
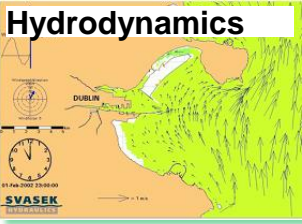
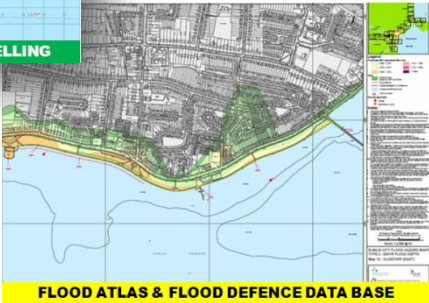
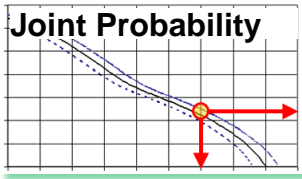
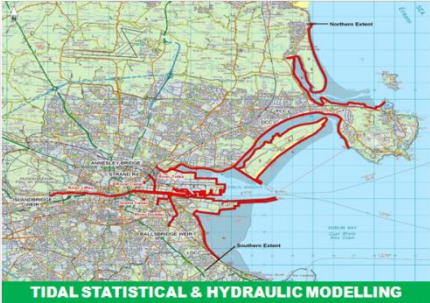
Glossary

CFRAM	Catchment Flood Risk Assessment & Management	MEM	Major Emergency Management
CIRIA	Construction Industry Research & Information Association	MEP	Major Emergency Plan
CMT	Crisis Management Team (City wide)	MWH	Montgomery Watson Harza (MWH Global)
CoP	Code of Practice	NOAH	Interreg IIIB project – NOAH (no acronym)
CoRes	Community Resilience (& potential EUFP)	OPW	Office of Public Works
DCC	Dublin City Council	SaSRaR	Streets as Streams Roads as Rivers
DEHLG	Department of Environment Heritage & Local Government	SAFER	Interreg IIIB project - Strategies & Actions for Flood Emergency Management
DFF	Dublin Flood Forum	<i>SICadapt!</i>	Interreg IVB Strategic Initiative Cluster for Adaptation to the Spatial Impacts of Climate Change
DFI	Dublin Flood Initiative	SLA	Strategic Learning Alliance
DTI	Dublin Transport	SSA	Strategic Support Alliance
EUFP	EU Future Projects Initiative	SuDs	Sustainable Drainage System
FLAG	Flood Assessment Group (Drainage)	WSUD	Water Sensitive Urban Design
FDU	Flood Defence Unit (Tide watch & flood watch)		
FPS	Flood Partnership (Project SAFER)		
FRC	Interreg IVB project – FloodResilienCity (part of FLAG)		
FEP	Flood Emergency Plan (a sub plan of the MEP)		
FRM	Flood Risk Management		
IPP	Individual Property Protection		
IPPA	Individual Property Protection Assessment		
IW	Irish Water		
LA	Local Authority		
LAP	Local Area Plan (subsidiary to City Development Plan)		

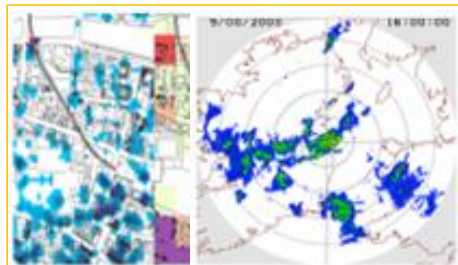
COASTAL Flood Risk Management



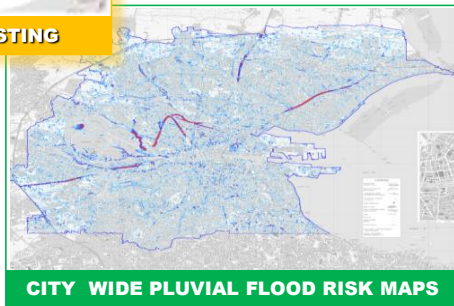
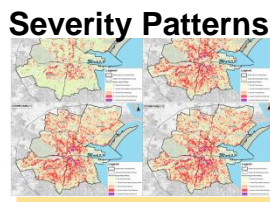
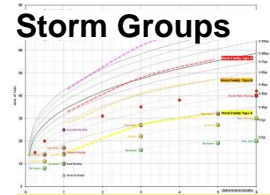
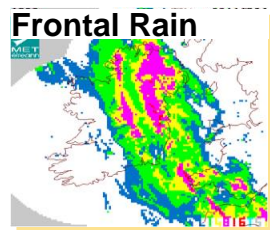
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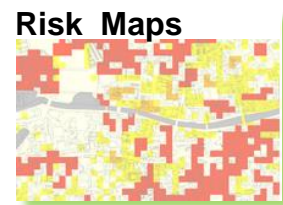
PLUVIAL Flood Risk Management



RAIN PATTERNS & FORECASTING



CITY WIDE PLUVIAL FLOOD RISK MAPS



PLUVIAL FLOOD RISK MANAGEMENT



Dublin Flood Forum

Appendix V3-A:
Code of Practice 1
SPATIAL PLANNING



Appendix V3-B:
Code of Practice 2
ADAPTATION



AWARENESS

ALLEVATION

AVOIDANCE

ASSISTANCE

STRATEGY & CAPACITY



FloodResilientCity

A3

3

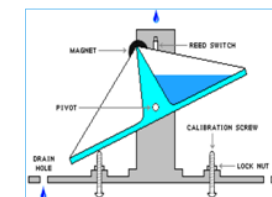
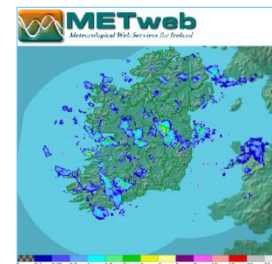


After Mitigation

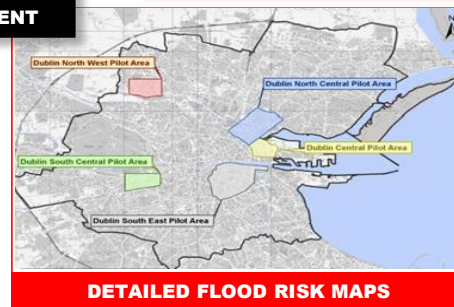


Before Mitigation

New Tools



New Technology



DETAILED FLOOD RISK MAPS



PLUVIAL FLOOD ALERTING & WARNING